MODERN PLASTICS

AUGUST 1958

HOT...AND GETTING HOTTER

For tremendously strong shapes that must resist fire, heat and corrosion, more designers than ever are specifying Hetron® polyester.

If you'd like a folder of facts on this fast-growing family of self-extinguishing resins, write:

DUREZ® HOOKER CHEMICALS PLASTICS

PLASTICS DIVISION

HOOKER CHEMICAL CORPORATION

1208 Walck Road, North Tonawanda, N. Y.

The shoe industry's new look in lasts

gets a **lift** from Catalin NYLON

Higher and sharper grow milady's heels, following the current vogue . . . and as the impact area of that slender spike against the ground becomes smaller, the greater is the need for a rugged, wear-scorning material to mold the lift that takes the beating.

If the little slice of substance too soon grows uneven from its tick-tack against the abrasive pavement, then slim ankles begin to wobble and hobble, shapely calves suffer strain . . . and the whole shoe is blamed by its charming purchaser.

Jamison* offers a solution . . . heel lifts in five sizes, molded of CATALIN NYLON! On heels such as those pictured — product of the New York Progressive Wood Heel Co., of Brooklyn, N.Y. — these CATALIN NYLON lifts have been proven to *outwear* the traditional type *four to one!*

In other applications, also, CATALIN NYLON exhibits unique properties — stability of form at high temperatures, toughness, abrasion resistance and strength in thin sections. Of particular importance is the comparative ease with which it can be molded or extruded. CATALIN NYLON is excellent for the production of gears, bearings, bushings, cams, coil forms, valve seats, medical items, combs, monofilaments, rods, tubes and tape. Inquiries invited.

*Nylon lifts are custom molded by Jamison Plastic Corp., No. Bellmore, N. Y. for Kingly Plastic Products Corp.

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Catalin

In addition to Styrene, Polyethylene and Nylon Compounds, Catalin chemical products include a wide range of Urea, Phenolic, Cresylic, Resorcinol, and Melamine Resin formulations

MODERN PLASTICS

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Number 12

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Another new development using

B.F.Goodrich Chemical *raw materials*

"Dish-Quick" all purpose spray and dishwasher made by Modern Faucet Mfg. Co., Los Angeles, California, uses hose made by Extruded Products Division, Stillman Rubber Company, Fullerton, California. Hose has synthetic rubber inner lining, nylon cord, and Geon polyvinyl jacket. B.F.Goodrich Chemical Company supplies the Geon polyvinyl materials only.

Geon jacket insulates faucet hose against kitchen corrosion

Who'd guess that a kitchen sink would be a tough place for rubber hose to perform? Experience proves that kitchen chemicals and grease will decompose a conventional rubber hose. The problem was solved with a jacket made from Geon polyvinyl materials.

Now the hose has excellent chemical, grease and abrasion resistance. There is less tendency to kink. And, thanks to versatile Geon, color can be built right in. Yet the heat resisting properties of rubber have been retained.

Here's another example of how you can open new markets or build a dramatic new or improved product with Geon polyvinyl materials. For more information, write Dept. LE-8, B. F. Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

B. F. Goodrich Chemical Company
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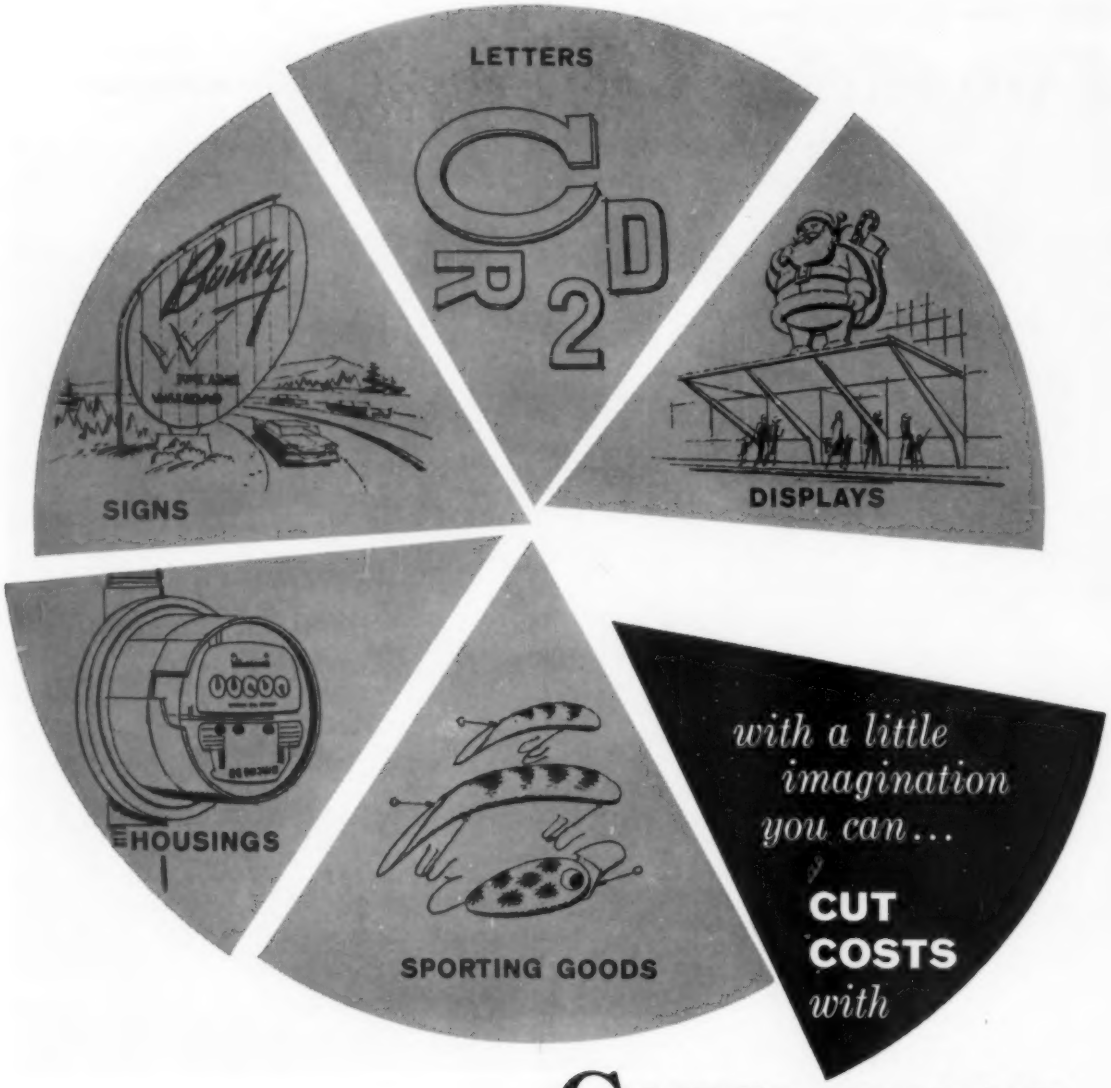
GEON polyvinyl materials • HYCAR American rubber and latex
GOOD-RITE chemicals and plasticizers • Harmon colors



CAMPCO BUTYRATE

The exceptional strength in thin sections characteristic of CAMPCO Butyrate puts substantial savings within your reach. A little goes a long way. It's easy to adapt most designs to take advantage of CAMPCO *stock* rolls and sheets – for additional savings. These come in a wide variety of sizes and gauges.

What's more, the sparkling colors possible with CAMPCO Butyrate stay bright and beautiful through long exposure to extremes of temperature and humidity. This makes it ideal for outdoor letters, signs, displays, housings and countless other applications.

CAMPCO Butyrate is available in thicknesses .005" to .125", in stock or custom sizes. Clarity ranges from transparent through translucent to opaque. It has uniform texture, high impact strength, dimensional stability and low moisture absorption.

How could *you* use the colorful sales appeal of low, low cost CAMPCO Butyrate? Write for price list and name of your nearest representative.

CAMPCO

a division of Chicago Molded Products Corp., 2721 Normandy Ave., Chicago 35, Ill.
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Editorial

Rumor market in plastics

A seething mass of rumor and innuendo concerning shifting sales policies of material makers underlies a current messy situation in the plastics industries.

Deals and dickers are reported by the scores, not only in connection with high-density polyethylene (although this is the material most frequently mentioned) but in vinyls, styrene alloys, and even in phenolics and polyesters.

The rumored negotiations fall into several patterns. First, there is the old business where a material maker may be persuaded to pick up a good share of the tab for molds for a proprietary plastics line such as housewares. Second (and sometimes coupled with the foregoing) there is the matter of who pays for product design and engineering. Third, there is the business of the material maker guaranteeing working capital loans for molders. Fourth, there is the matter of contract sales with escalator clauses. Fifth, there is plain ordinary price cutting.

Throughout history, material makers have made investments in cooperation with molders to open up new markets. The designs and molds for the first melamine tableware were provided by a material maker to prove up a market. The molds for the first plastics furniture drawers were built at the expense of a chemical company.

Likewise, machine re-design for processing new plastics has traditionally been largely the responsibility of the material makers—and occasionally some financing was involved.

The present rumored instances differ considerably from those in which new materials were being groomed for new markets. The present rumored instances, indeed, represent a battle for business in which all blows are landed below the belt, the fighters are blindfolded by fast-talk rumor, and the customer is the referee.

If this thing continues, both individual companies and the plastics industries in toto can be seriously injured. If the price of any plastic is driven low enough by a rumor sales psychology in an era haunted by high capacity, research will stop—and on research has been based the success of plastics.

It is about time for material makers to come out with flat statements of non-shifting sales policies. It is time for customers' purchasing agents and materials salesmen alike to stop listening to and disseminating rumors. It is time we developed stiffer spines at all levels of these industries.

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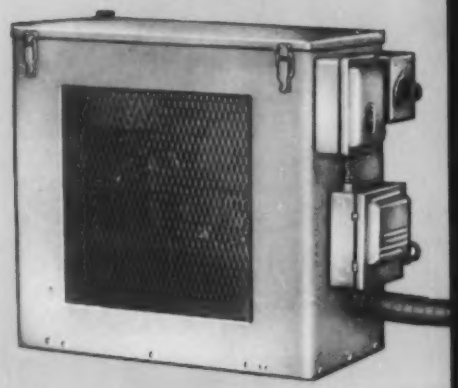
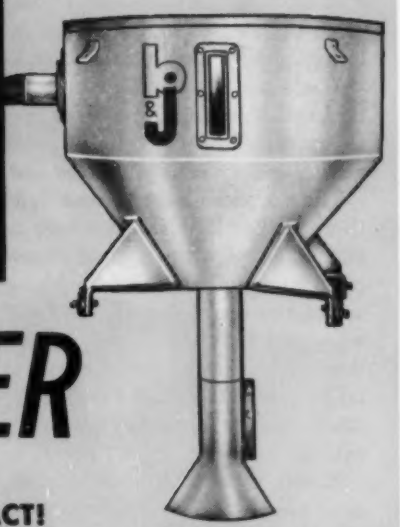


the money you save by eliminating rejects will pay for a



NEW B & J HEATER-DRYER

(HOPPER ATTACHMENT)

NEW DESIGN! MORE EFFICIENT! MORE COMPACT!

The newly designed B & J Heater-Dryer will give you more full shots, better surface quality and improved physical properties with a greatly reduced reject rate that will save you money. In fact, the elimination of rejects will save you enough money to pay for a B & J Heater-Dryer that will condition, dry, and pre-heat the material right in the hopper of your injection molding or extruding machine. The Air-Maze filter, with washable filter element, removes dust and dirt from the air. The round B & J Hopper eliminates "dead" spots...heat is spread uniformly . . . moisture is dispersed faster. You get positive control of temperature from 150° to 235°F . . . with no chance for heat loss or contamination as can occur in transferring materials from drying ovens.

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WANT MORE INFORMATION?

Write today for Bulletin D558. It describes the B & J Heater-Dryer in detail. Also ask for our 8-page reprint of the results of a quantitative study of pre-heating polyethylene and impact polystyrene before extrusion.

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Moist surface or cloudiness	Material too cold, material improperly dried

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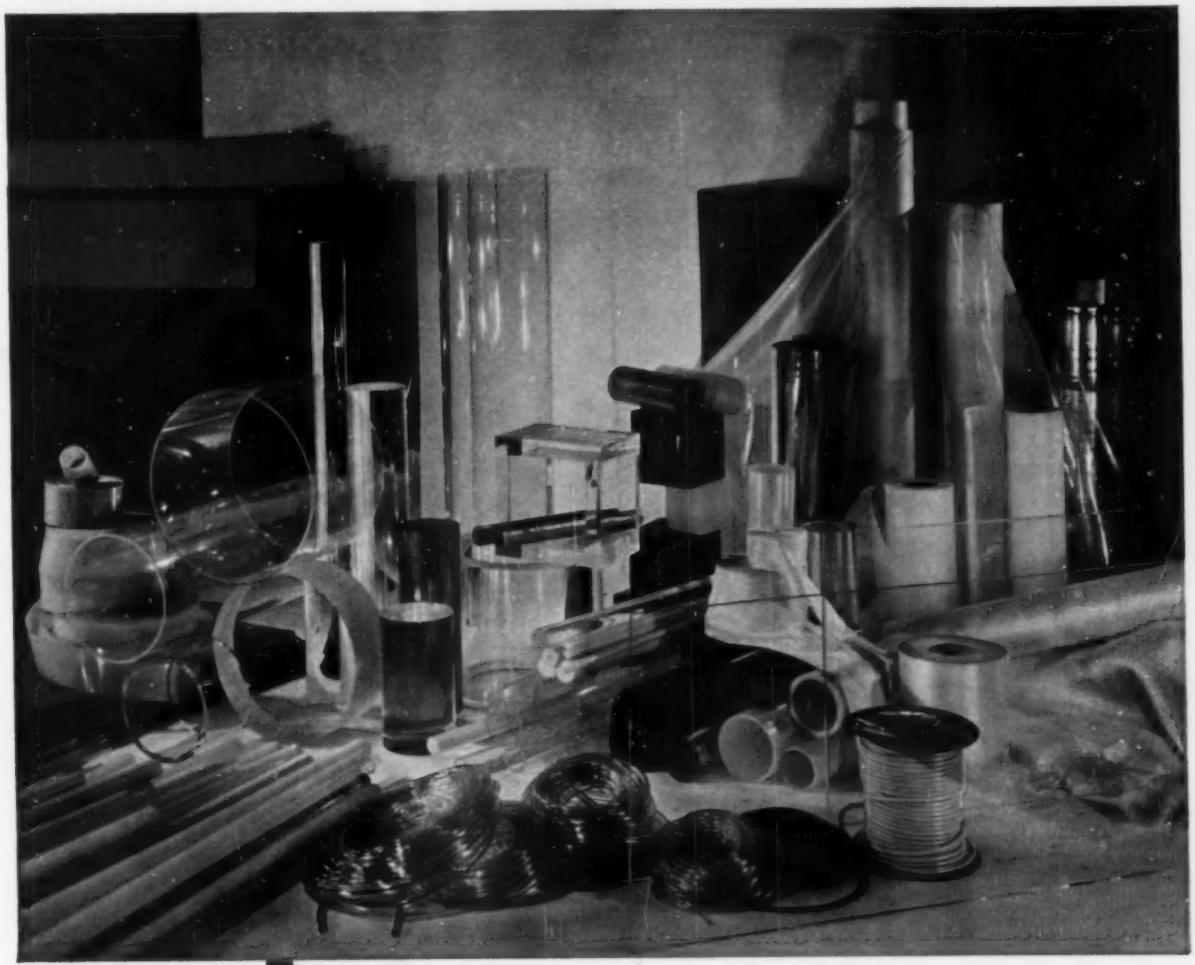

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To meet your every need in plastics reducing machinery—whether for beside-the-press operation or for heavy duty chunk grinders — ALSTEELE GRANULATORS come in 26 models ranging in size from 3 HP to 200 HP, with cutting chambers up to 5'.

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Soon to be introduced is a new Alsteele Dicing Machine—for making perfect cubes from ribbon.

Alsteele Granulator: 100-150-200 HP

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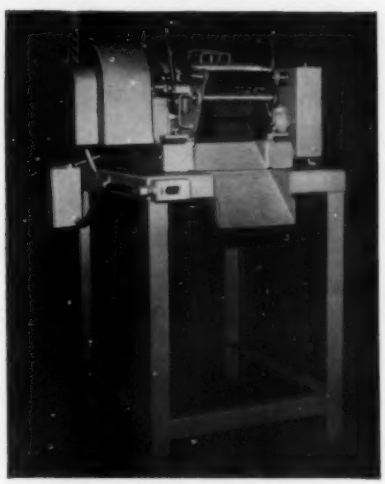
Additional features are excellent uniformity of pellets, and clean cutting action—even on elastomerics. A greatly lowered noise level is still another benefit.



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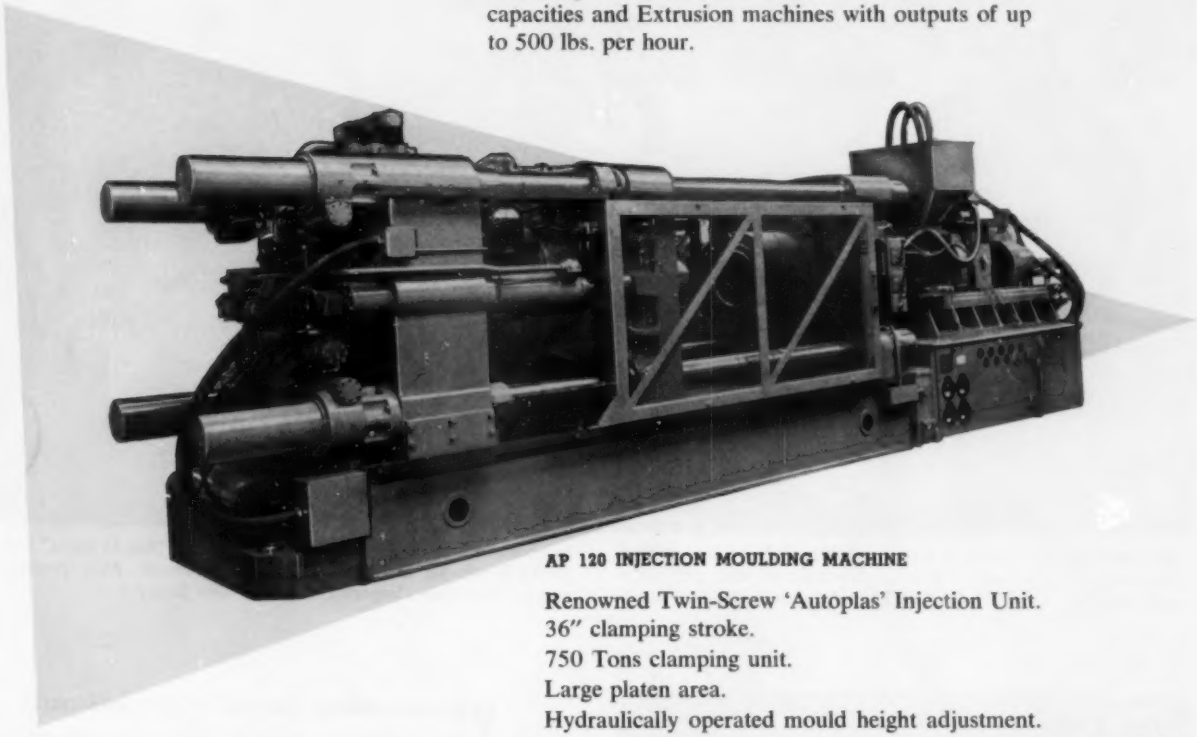
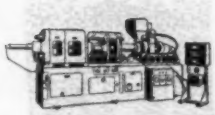
THE ULTIMATE IN ACHIEVEMENT

Every machine in the Windsor range is of sound design and workmanship, produced to the fine standards which have made Windsor first and foremost in the world of plastics engineering. Windsor Injection Moulding machines are available from 1 to 200-ounce capacities and Extrusion machines with outputs of up to 500 lbs. per hour.

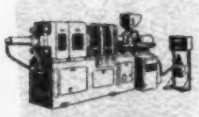


AP 120 INJECTION MOULDING MACHINE

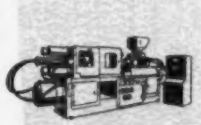
Renowned Twin-Screw 'Autoplas' Injection Unit.
36" clamping stroke.
750 Tons clamping unit.
Large platen area.
Hydraulically operated mould height adjustment.
120 cubic inch capacity, equal to approx. 70 ounces of Polystyrene.



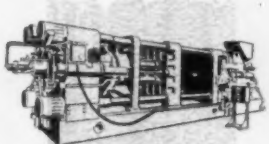
AP 1044 Injection Moulding Machine



AP 2088 Injection Moulding Machine



W.20 Injection Moulding Machine



AP 335 Pre-plasticizer

* *Fully illustrated literature available on request*

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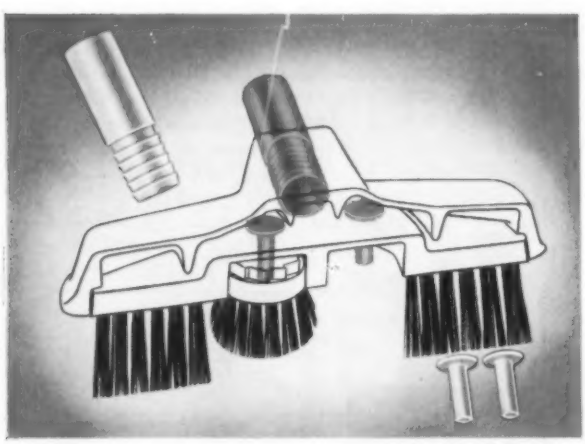
5 more examples showing

LIGHTWEIGHT mechanical device supports saxophone on a cord of adjustable length. Parts of ZYTEL nylon resin are strong and durable...operate with little friction. They are economically produced to accurate dimensions by injection molding. ("Sax-O-Matic" by Hertz Music-All Instrument Company, Newark, New Jersey; molded by Fibro Corporation, Clark, New Jersey.)



CONNECTOR in twin-spin fountain brush is strong, tough, light in weight. Made from ZYTEL nylon resin, it cannot corrode and disassembles readily for insertion of a detergent pellet. Axle-pin bearings replace aluminum, providing much lower friction. (Made by Laitner Brush Co., Detroit, Mich.; moldings of ZYTEL by St. Clair Plastics, Marine City, Michigan.)

You can reduce the cost of product parts by designing with ZYTEL nylon resins. When your design calls for heavy walls to meet strength requirements, a thinner wall of ZYTEL may do the job just as well.

Moreover, you can take advantage of the resilience of ZYTEL to get rid of extra-close tolerances...an important way to save money. An example is the use of ZYTEL for *gears*. Because ZYTEL can deform and recover much more easily than steel, it has a built-in tolerance factor. Periodic overloads cause temporary deformation, which spreads the load over at least two teeth. Like other intricate shapes, gears of ZYTEL can be produced economically. They run quietly, with a minimum of lubrication.

how Du Pont ZYTEL® nylon resins make new products possible... existing products better

RUGGED GEAR AND CLUTCH ACTIVATING BAND for power mower are two of many parts molded of ZYTEL nylon resin. Gears of ZYTEL operate quietly and often outwear metal components. These parts provide simplified fabrication and reduced costs. (Mower by Clemson Bros., Inc., Middletown, New York.)

WASHER on self-tapping screw is made of ZYTEL. It seals against leaks, cushions vibration, protects brittle finishes. ("Nyltite Staps" by Parker-Kalon Division of General American Transportation Corp., Clifton, New Jersey; rolled washers by Nyltite Corporation of America, Newark, New Jersey.)

ELECTRICAL CONTACT ASSEMBLIES feature cost savings and increased reliability. Molding with Du Pont ZYTEL nylon resin produces a uniform product with good heat resistance for use with switches, potentiometers, commutators. (Manufactured by The J. M. Ney Co., Hartford, Connecticut.)

The versatility of ZYTEL enables you to concentrate features into a single part. Often, an assembly of several pieces can be molded into a single strong part of ZYTEL. Complex components can be injection-molded at high speed. Finish is so accurate that after-molding work is frequently unnecessary.

To help save you time, trouble and money, we've just issued a new, information-packed manual, DESIGNING WITH *ZYTEL*® NYLON RESIN. Send the coupon to obtain it.

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To prevent moisture and dust from entering automobile light sockets, a **chem-o-sol** was specially formulated for an economical high-speed dipping process (no costly molds required). It provides a tough, flexible coating. *(Watts Electric & Mfg. Co.)*

To resist corrosion, drums, tanks, and other large irregularly-shaped objects are sprayed with a structurally strong **chem-o-sol.** Cost savings of up to 35% result, and films of from 5 to 100 mils are possible.

To provide an essential coating for glass yarn used in strong, weather-resistant screening, a **chem-o-sol** with the correct flow properties was produced for economical application by high-speed die-wiping. *(Owens-Corning Fiberglas Corp.)*

To produce a tight seal that is permanently flexible and durable, a specially formulated **chem-o-sol** was tailored for clay pipe joints. A "flowed-in" gasket, it's applied by an in-plant molding process.

What they're doing with

may suggest an easier way to

ECONOMICAL TO APPLY
chem-o-sol ALSO HELPS CUT PRODUCTION COSTS

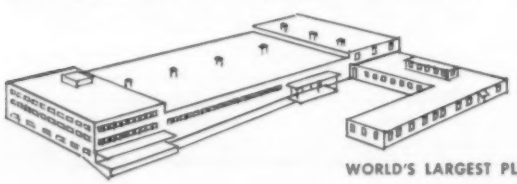
These are just a few of the applications already developed for Chem-o-sol. So versatile is this polyvinyl dispersion . . . so advanced the research, so vast the formulating experience and production capacity of Chemical Products Corporation that Chem-o-sol's product improvement possibilities are virtually *unlimited.*

For Chem-o-sol is more than a coating or molding *compound.* It is a new production tool! Formulated as a liquid without volatile components, it is converted to a strong, resilient solid simply by heating to about 350°F., *without pressure.*

Since each Chem-o-sol formulation is "tailor-made" to best suit the specific requirements of the end use, the formulator's touch is indispensable for translating ideas into reality.

To its practical experience, unsurpassed in point of time or scope, Chemical Products Corporation adds the world's largest and most modern facilities for the development and production of polyvinyl dispersions, including a completely equipped research laboratory to serve you.

IS THERE AN IDEA HERE for improving your own product? Then tell us about the proposed end use of Chem-o-sol.



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To impart a slip-proof, safety grip and increase wearability of cotton work gloves, palms and fingers are strategically dotted with **chem-o-sol** specially formulated to permit printing on fabrics at high speeds. *(Wells Lamont Corp.)*

To deaden noise, protect dishes from chipping, and resist grease and detergents, the familiar drainer is dipped in a special **chem-o-sol.** Wire constructions and metal and glass objects are coated easily and economically because only one dipping operation is necessary. Thickness to 60 mils is possible, in wide range of finishes.

To seal the new dry type automotive air cleaner into the car silencer and act as a structural member of the pleated paper element, a **chem-o-sol** was compounded for high-speed molding. Pre-cut gaskets and metal stampings were eliminated. *(Fram Corporation.)*

To improve heat resistance and physical and electrical properties of coatings for flexible sleeving (spaghetti tubing) used in electrical components, a **chem-o-sol** was tailor-made for heat resistance of more than 2000 hours at 225°F.

improve your product

TECHNICAL FACTS ABOUT **chem-o-sols**

Chem-o-sols possess all the outstanding physical and chemical properties associated with polyvinyl chloride resins. Listed below are some of the properties available in almost any combination.

COLOR CHOICE — unlimited

TENSILE STRENGTH — as required from 1000 psi. to 2700 psi.

PERCENT ELONGATION — 350 to 600

HARDNESS (shore A2) — as required from 10 to 100
(shore D) — up to 65

FLEXIBILITY — to temperatures as low as —65°F

CHEMICAL RESISTANCE — outstanding to most acids, alkalies, detergents, oils and solvents

HEAT RESISTANCE — available to 225°F for as long as 2000 hours and to 450°F for over two hours

DIELECTRIC STRENGTH — minimum of 400 volts per mil when fused in sections 3 mils thick and over

SOLIDS CONTENT — 100%. Chem-o-sols can be molded in very thick sections

VISCOSITY — as required for dipping, die wiping, molding, casting, spraying, or spreader coating

CHEMICAL PRODUCTS CORPORATION
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Title .....

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Proposed end use .....

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Application method .....

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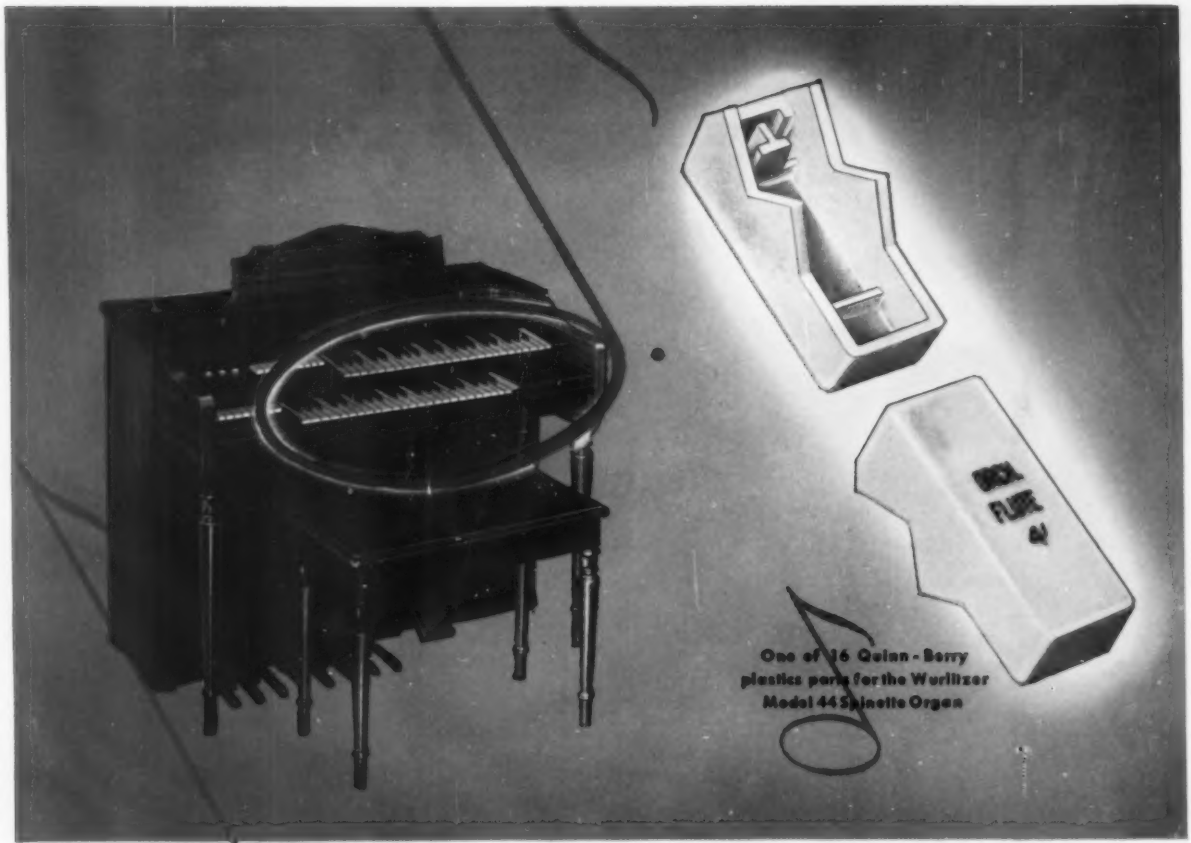

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Close tolerances, dimensional stability, flawless finish, strict color uniformity . . . these are some of the rigorous specifications handed to Quinn-Berry for the 16 thermoplastic parts used in the Wurlitzer Spinette Organ.

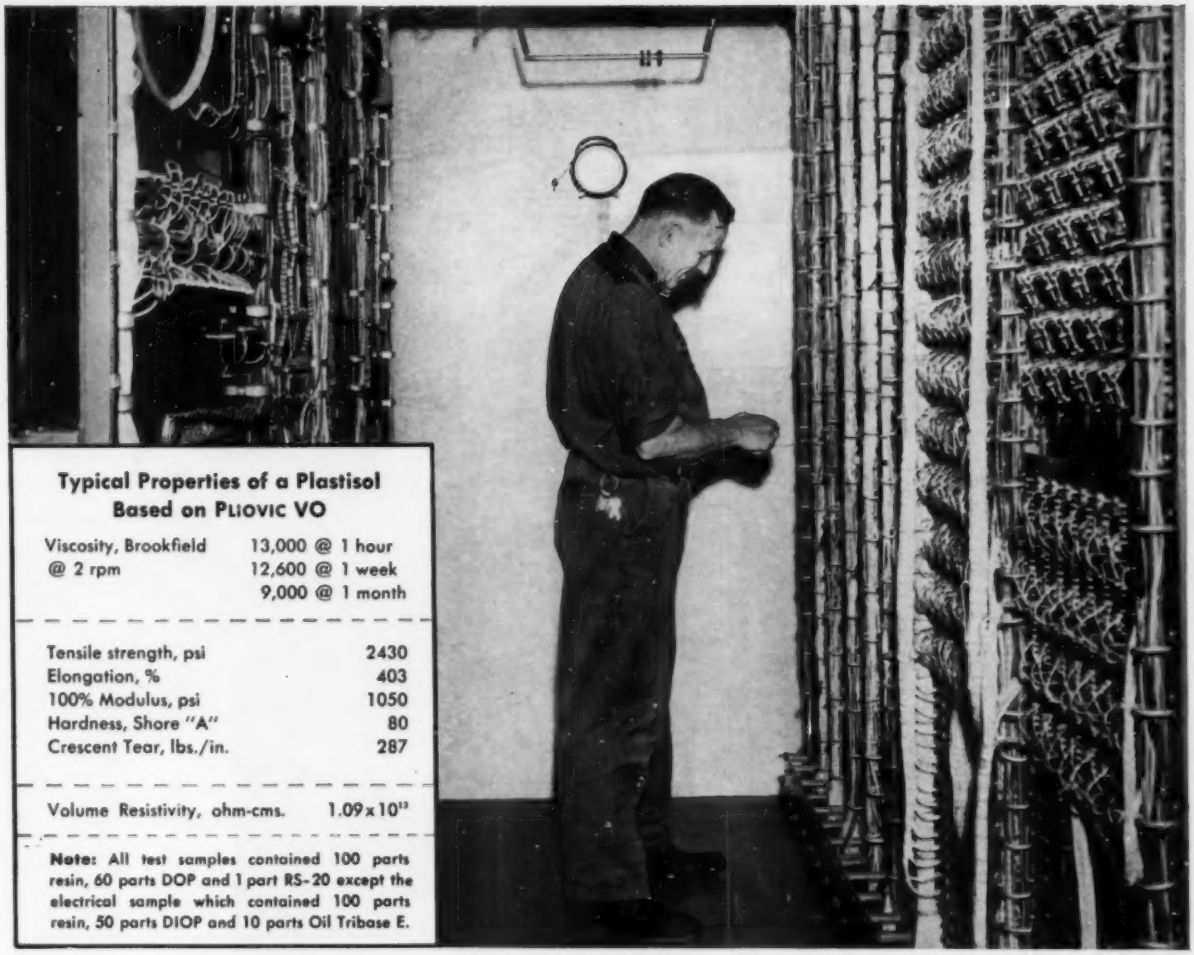
Successful production of these precision parts requires careful choice of the right thermoplastics, skillful mold design and manufacture, dependable press room craftsmanship . . . capabilities which have gained for Quinn-Berry an enviable reputation as a resourceful molder of precision thermoplastic parts.

You will profit by putting your component parts needs up to Quinn-Berry where "The Unusual Is Routine".

WE FLY TO SERVE YOU FASTER!

QUINN-BERRY CORP.
2609 WEST 12TH STREET, ERIE, PA.

HOLDERS OF ALL TYPES OF THERMOPLASTICS



Typical Properties of a Plastisol Based on PLIOVIC VO

Viscosity, Brookfield @ 2 rpm	13,000 @ 1 hour 12,600 @ 1 week 9,000 @ 1 month
Tensile strength, psi	2430
Elongation, %	403
100% Modulus, psi	1050
Hardness, Shore "A"	80
Crescent Tear, lbs./in.	287
Volume Resistivity, ohm-cms.	1.09×10^{13}

Note: All test samples contained 100 parts resin, 60 parts DOP and 1 part RS-20 except the electrical sample which contained 100 parts resin, 50 parts DIOP and 10 parts Oil Tribase E.

New—and purely superior!

If you're looking for something new and different in dispersion resins, particularly for use in electrical applications, you can stop right now. For in new PLIOVIC VO, we have just that.

PLIOVIC VO is a straight polyvinyl chloride resin of exceptional purity. It is designed and made for use in plastisols and organosols for electrical applications, for rotational and slush molding, for metal coatings and for dip coatings.

Compounds based on PLIOVIC VO exhibit the following characteristics: 1. Extremely low initial viscosity. 2. Outstanding shelf stability. 3. Superior electrical properties. 4. Excellent heat stability. 5. Good physical properties. 6. Exceptionally low water absorption. 7. Good film clarity.

Plastisols made with PLIOVIC VO are effectively protected against heat and light with small amounts of economical zinc-type stabilizers. They also are readily deaerated to assure uniform cross sections. And they exhibit a very desirable, dry, nongreasy feel. For full details, including the latest *Tech Book Bulletins*, on the new PLIOVIC VO, the unique PLIOVIC AO, or their blends, just write to: Goodyear, Chemical Division, Akron 16, Ohio.

CHEMIGUM
PLIOFLEX
PLIOLITE
PLIOVIC
WING-CHEMICALS

High Polymer Resins, Rubbers, Latices and Related Chemicals for the Process Industries

CHEMICAL
GOODYEAR
DIVISION

PLASTICS
DEPARTMENT

60 YEARS GOODYEAR

Chemigum, Pliolite, Pliovic—T. M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

- *quality*
- *service*
- *dependability*
- *savings*

GERING

MOLDING COMPOUNDS

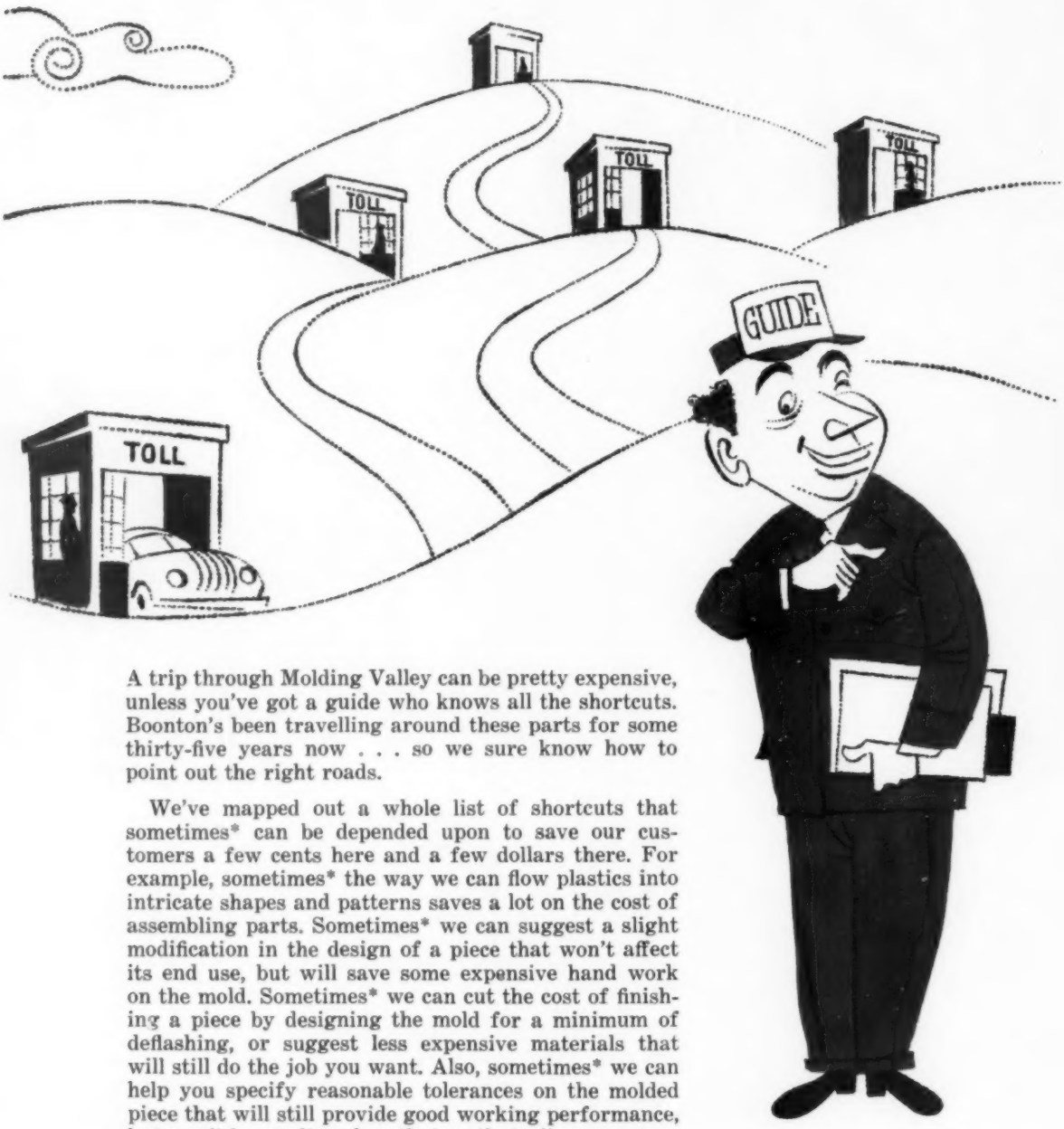
- **VIRGIN MOLDING COMPOUNDS**—Vinyl, Polyethylene, Acetate, Polystyrene, Impact Styrene
  —**"COLOR COMPOUNDING SPECIALISTS"**—Your orders formulated to exact color, flow and physical properties specifications.
- **REPROCESSED MOLDING COMPOUNDS**—Polyethylene, Vinyl, Polystyrene, Acetate, Nylon, Acrylics, Impact Styrene, Butyrate
  —**"CUT COSTS WITHOUT SACRIFICING QUALITY"**—Supplied in uniform, dust-free pellets . . . perfectly matched from first bag to last.
- **RIGID QUALITY CONTROL • COMPETITIVELY PRICED • SPEEDY DELIVERY**—no matter how large your order! Write Us About Your Specific Needs Today!

GERING

Molding Compounds

Gering Products, Inc., Kenilworth, N.J. Sales Offices: 5143 Diversey Ave., Chicago 39, Ill. • 424 Chevy Chase Rd., Mansfield, Ohio • 103 Holden St., Holden, Mass.

Good spot for a guide



A trip through Molding Valley can be pretty expensive, unless you've got a guide who knows all the shortcuts. Boonton's been travelling around these parts for some thirty-five years now . . . so we sure know how to point out the right roads.

We've mapped out a whole list of shortcuts that sometimes* can be depended upon to save our customers a few cents here and a few dollars there. For example, sometimes* the way we can flow plastics into intricate shapes and patterns saves a lot on the cost of assembling parts. Sometimes* we can suggest a slight modification in the design of a piece that won't affect its end use, but will save some expensive hand work on the mold. Sometimes* we can cut the cost of finishing a piece by designing the mold for a minimum of deflashing, or suggest less expensive materials that will still do the job you want. Also, sometimes* we can help you specify reasonable tolerances on the molded piece that will still provide good working performance, but won't be so ultra-close that costly tooling, unnecessarily close inspection, and wasteful rejections are involved.

So why travel the expensive route when a clever old guide like Boonton's around to help you by-pass the trouble spots.

**Please note the careful choice of words.*

BOONTON MOLDING CO.

BOONTON, NEW JERSEY

New York Metropolitan Area—Cortlandt 7-0003
Western New York Area—Alden 7134
Connecticut Area—Woodbine 1-2109 (Tuckahoe, N. Y.)
Philadelphia Area—Pioneer 3-0315

Strong, durable MARLEX cordage is ideal for fish nets, life lines, signal halyards, life nets, and general purpose rope.

MARLEX water ski rope actually floats. It doesn't sink to become lost or snarled around propeller and rudder.

Here's a marine hawser that a man can throw with ease... wet or dry! Does not absorb water or freeze stiff in cold weather. Available in high visibility colors.

The best plastic cordage is made of MARLEX*

inexpensive... amazingly tough and durable!

Filaments made of MARLEX high-density polyethylene have a superior tensile strength of 50,000 to 130,000 pounds per square inch, depending on diameter and drawdown. This excellent strength is coupled with light weight. This means that you actually get about 50% more feet of rope when you buy MARLEX rope instead of an equal weight of manila. Furthermore, MARLEX rope averages one and a half times the strength of manila rope of equal size.

MARLEX rope has extremely good resistance to moisture and chemicals. It won't rot. You can put it away wet. No need to dry before storage.

At low temperatures, MARLEX rope is more flexible than other ropes. It does not lose strength when wet and has better water repellency than more expensive nylon rope which, of course, does not float as MARLEX does.

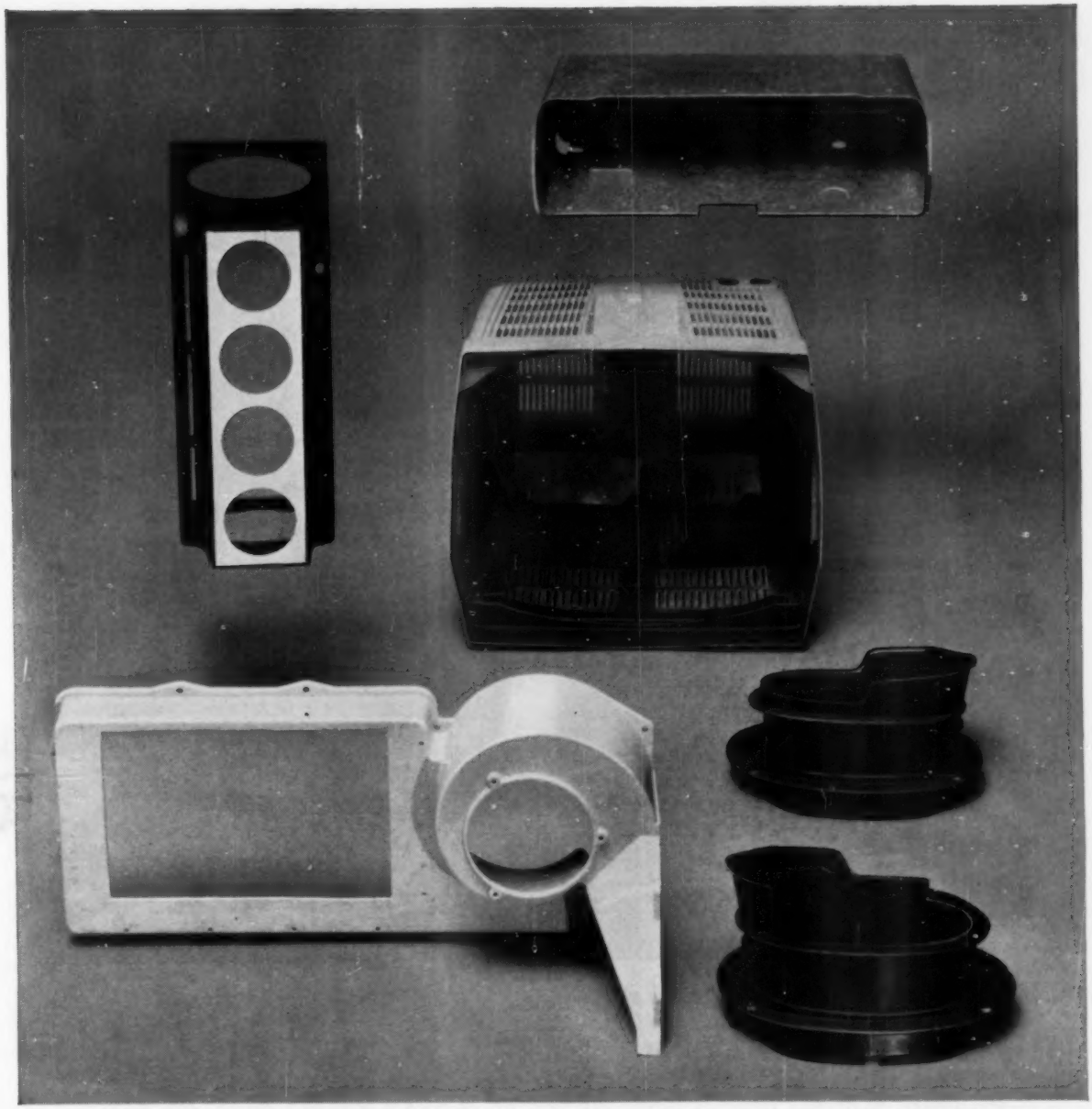
Investigate MARLEX—no other type of material can serve you so well—in so many ways—at such low cost.

*MARLEX is a trademark for Phillips family of olefin polymers.

PHILLIPS CHEMICAL COMPANY, Bartlesville, Oklahoma
A subsidiary of Phillips Petroleum Company

PLASTICS SALES OFFICES

NEW ENGLAND	NEW YORK	AKRON	CHICAGO	WESTERN	SOUTHERN & FOREIGN
322 Waterman Avenue, East Providence 14, R. I. GEneva 4-7600	80 Broadway, Suite 4300 New York 5, N. Y. Digby 4-3480	318 Water Street, Akron 8, Ohio FRanklin 6-4126	111 S. York Street, Elmhurst, Ill. TErrace 4-6600	317 N. Lake Ave., Pasadena, Calif. RYan 1-0557	Adams Building, Bartlesville, Oklahoma Bartlesville 6600, Ext. 8108



Wide range of premix moldings by the Plastics Division of General American Transportation Corporation includes: automotive air conditioning cabinet for O. A. Sutton Corp., Inc.; Silvertone portable TV cabinet for Sears, Roebuck and Co.; air duct and glove compartment for a leading automobile manufacturer; vending machine air duct for Vendo Co.

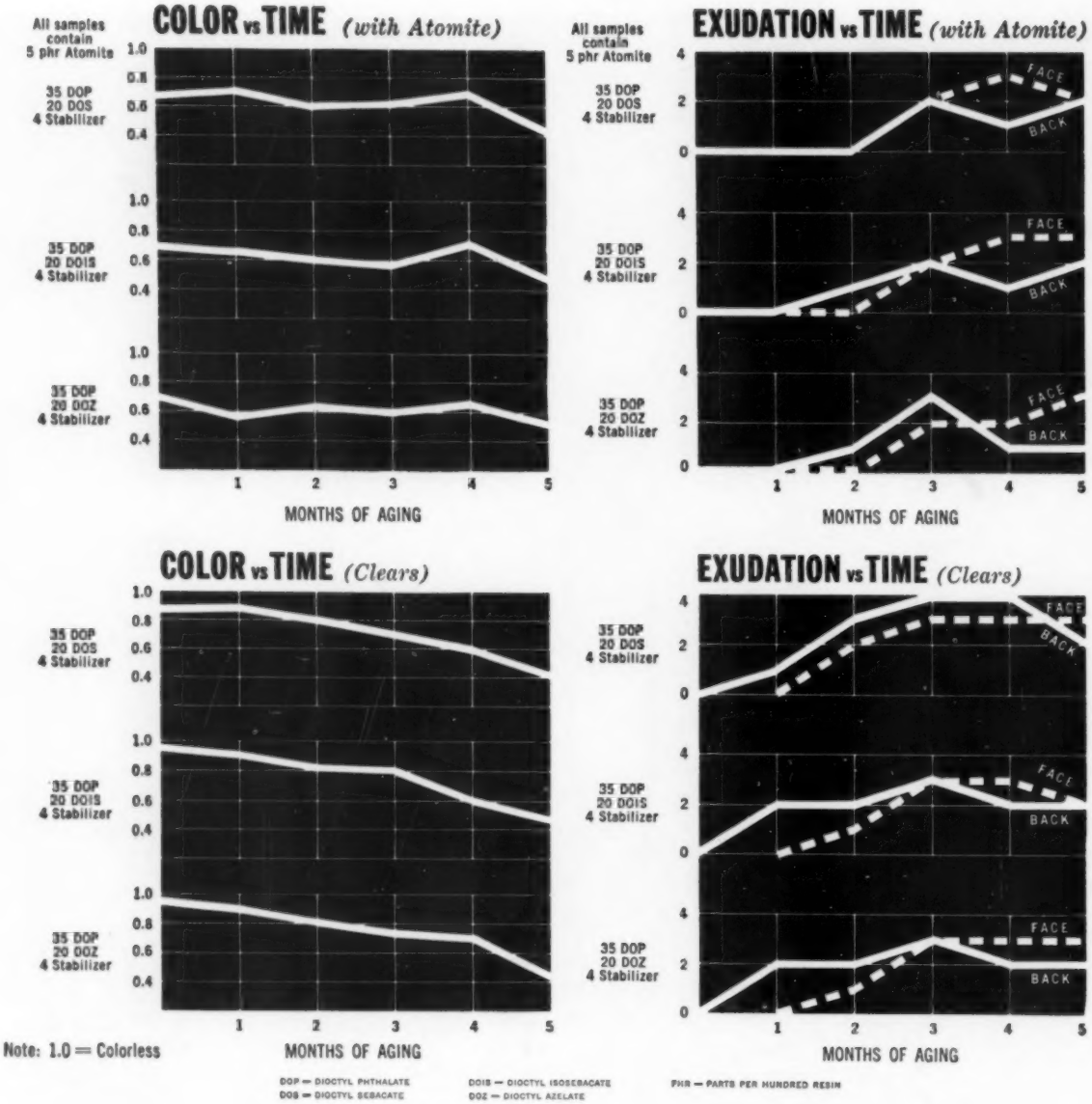
Premix moldings give you all three... quality, economy, versatility

Like to market better products and cut costs at the same time? Then premix moldings are for you!

When resins and reinforcing fibers are blended beforehand, more complex molds are not only possible but completely practical. Slots, grooves, holes, bosses and parts with varying wall thicknesses can be formed right in the mold. And whether the part is simple or complex, you'll get moldings with uniform strength and wall thicknesses. Premix moldings are improving products and cutting costs for a wide variety of industries using strong, rigid, reinforced plastics.

Molders across the nation rely on Dow Vinyltoluene and Dow Styrene for top-quality premix moldings. They can help you to better products at lower costs. For the names of molders and suppliers, contact your nearest Dow Sales office or write to THE DOW CHEMICAL COMPANY, Midland, Michigan, Plastics Sales Dept. 2206F-1.

YOU CAN DEPEND ON DOW



Florida aging tests show ester of **ISOSEBACIC® ACID** matches performance of other vinyl plasticizers ...and it is more economical

The dioctyl ester of ISOSEBACIC® acid matches the performance of more costly dioctyl sebacate and azelate as a plasticizer for vinyl resins. The evidence is provided by the above charts of a recent, independently conducted test.*

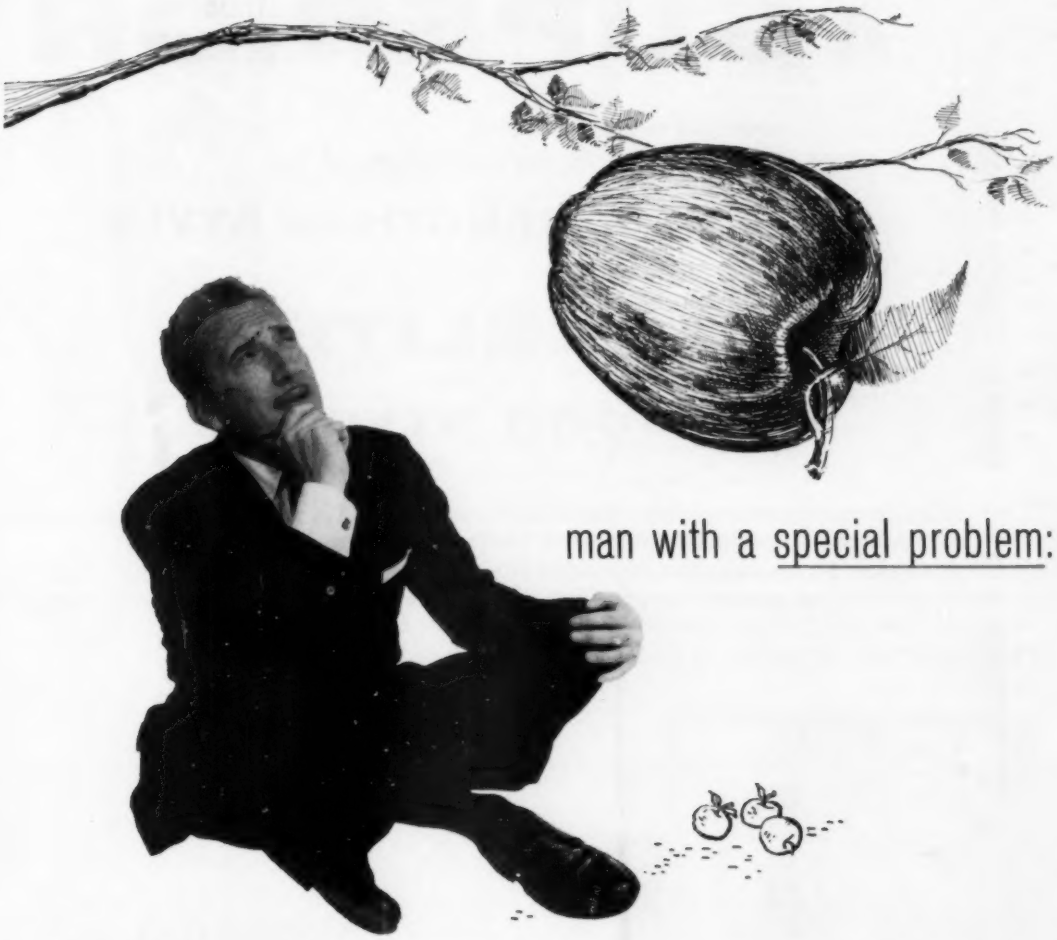
ISOSEBACIC acid is a new synthetic intermediate made by U.S.I. A mixture of three C-10 dibasic acids —2-ethyl suberic, 2, 5-diethyl adipic, and sebacic acids— it offers a number of interesting properties. Other uses include—intermediate for polyamides, polyesters, polyurethanes and alkyd resins.

ISOSEBACIC acid soon will be available in commercial quantities from U.S.I. at Tuscola, Ill. Price comparisons with competitive intermediates indicate that ISOSEBACIC acid will afford important savings.

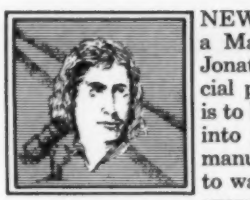
This might be a good time to evaluate ISOSEBACIC acid for your operations. Send for data sheets and samples.

*Test results supplied through the courtesy of Doecy Products Co., Cambridge, Mass.

U.S.I. INDUSTRIAL CHEMICALS CO.
Division of National Distillers and Chemical Corp.
99 Park Ave., New York 16, N. Y.
Branches in principal cities



man with a special problem:



NEWTON solved *his* problem with a Mackintosh (some say it was a Jonathan). There's a key to *your* special problem, too—important thing is to be able to spot it when it drops into your lap. Busy designers and manufacturers today are wise not to wait for that unlikely event. For example, to find the phenolic molding compound that best answers their particular need . . . unusual as it may be . . . they go directly to the *specialists* in such problems. They consult with Plenco.

AT PLENCO, your special needs are given the special attention they require. Quite often that means designing a new formulation or a new combination of thermosetting phenolic materials specifically suited to meet your product or production problem. Plenco is ideally set up to produce such *special-purpose* molding compounds.

For, to our way of thinking, the versatility and value of phenolics is bounded only by the experience and initiative that goes into their production . . . and into the preliminary discussion of the problem. We've proved that again and again. We'd like to prove it to you. *If phenolics can do it . . .* ready made *or* custom made . . . *Plenco can provide it.*

PLENCO phenolic molding compounds

PLENCO PHENOLICS
FOR BETTER PLASTIC PRODUCTS

PLASTICS ENGINEERING COMPANY
Sheboygan, Wisconsin

Serving the plastics industry in the manufacture of high grade phenolic molding compounds, industrial resins and coating resins.

A SUPERIOR

specifically designed for

IMPACT STRENGTH *and* STYLE

BAKELITE

BRAND

TGD-6000 STYRENE

This high-impact, rubber-modified extrusion compound is the result of a development program to provide extruders and vacuum formers with preferred features: strength, eye appeal and durability.

In addition this improved BAKELITE Brand Styrene extrudes at faster rates—has exceptionally high elongation values—possesses permanent high gloss and excellent rigidity. TGD-6000 Styrene is available in a wide variety of colors that retain stability even under heat polishing.

Write Dept. HC28H for Technical Release #15 giving complete fabrication details.

TGD-6000 is particularly suited for use in refrigerator door liners for two important reasons: 1. *lustrous appearance and smooth surface* for eye appeal and ease of cleaning; 2. *high* impact strength, even at subnormal temperatures. TGD-6000 permits the use of thinner sections.

SUPERIOR EXTRUDABILITY

TGD-6000 is capable of fast extrusion, with high quality, on conventional equipment.

RECOMMENDED EXTRUSION CONDITIONS

Screen pack	20/60/80 mesh
All cylinders	350-400 deg. F.
Head temperature	400 deg. F.
Die temperature	420 deg. F.
Feed end	Cold water
Screw temperature	Neutral
Compound temperature at discharge	410-425 deg. F.

8-2028

STYRENE

TYPICAL PROPERTIES

Values Relating to Fabrication

Extrusion Compound Temp. at Die, deg. F.	400-425
Specific Gravity (D792-50)	1.04

Values from Mechanical Tests*

Izod Impact Strength (D256-56), ft-lb/in. of notch	1.0
Tensile Strength (D638-56T) psi	3400
Elongation in Tension (D638-56T), per cent	30
Flexural Strength (D790-49T), psi	8000
Modulus of Elasticity in Flexure (D790-49T), psi	370,000

Values from Miscellaneous Tests*

Thermal Coefficient of Linear Expansion (D696-44) per deg. C.	8×10^{-5}
Water Absorption (D570-54T), per cent gain in weight in 24 hours	0.12
Durometer Hardness (D676-55T), D Scale	80

*Values obtained from extruded sheet 0.100 in. thick

EASIER VACUUM FORMING

Because TGD-6000 possesses such excellent strength and elongation properties, sheets may be formed and deep drawn in highly detailed designs—without cracking, breaking or warping at corners. High gloss surface is maintained during deep-draw vacuum forming.

TGD-6000 affords extruders and vacuum formers design and production advantages to expand their facilities to include a broader range of specialized applications and new products. Suggested other uses include displays, signs, toys, television masks, appliance housings, guards and novelties.

BAKELITE BRAND **PLASTICS**

Products of UNION CARBIDE *Corporation*

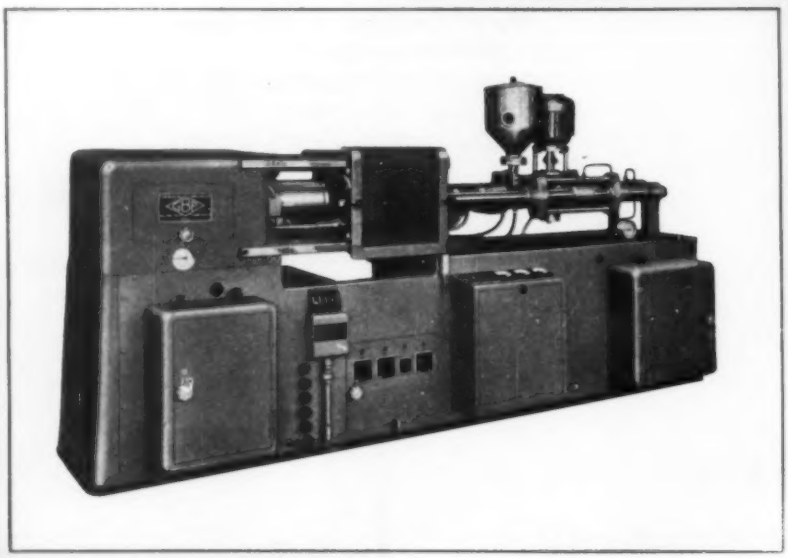
BAKELITE COMPANY, *Division of Union Carbide Corporation,* 30 East 42nd Street, New York 17, N. Y.
The terms BAKELITE and UNION CARBIDE are registered trade-marks of UCC.

NEW DEVELOPMENT

DYNAMIC PREPLASTICIZER
FAST INJECTION SPEED

G. B. F. "PLASTINIECTOR"
world patent

mouldo better
mouldo faster
self-contained
fully automatic
all hydraulic



"PLASTINIECTOR 80"
capacity: 4 oz.
7 c. inch

ADVANTAGES:

1. Uniform plasticizing and high injection rate at lower temperature.
2. Total pressure directly on the material.
3. Extremely fast injection.
4. Exact weight of each shot due to the volumetric injection of the preplasticized material.
5. Low injection pressure.
6. No change of container for the various materials and colours.
7. Automatic operation cycle regulable by timers and continuously controlled.
8. Parts better in quality and uniform in size, also on large areas and on thin walled sections

GBF

COSTRUZIONI MECCANICHE s.r.l.
BRESSO (Milano)—**Italy**

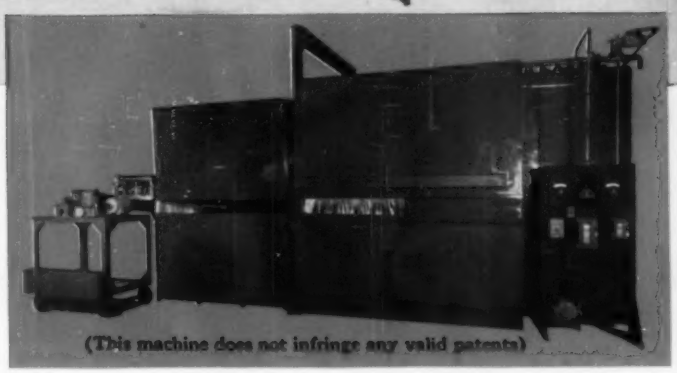
World Distributors:

COVEMA s.r.l.—MILANO (Italy)

Via Fontana 5—tel. 705.735—709.356
cables: Covema—Milano

LOW COST MOLDING MAGIC

Mold small or large vinyl products economically!



(This machine does not infringe any valid patents)

Now a low capital investment provides you with this single spindle production machine capable of rotationally molding small or large products. This type machine is made with a 25" diameter molding area and a 75" diameter molding area, which gives you a selection of 5 different machines designed for small, medium or large quantity production.

This is a complete unit for manufacturing products from polyvinyl chloride plastisols, vinyl foam, or polystyrene expandable beads. The manufacturing process is simplified because the materials are scientifically prepared by the nation's foremost companies specifically for your product.

Whether you want small, medium or large quantity production equipment, the Akron Presform Mold Co. can supply your needs with rotational molding machines, dispensing units and molds to produce any item you select. We'll be glad to show you actual facts and figures and your own product being made. Let us demonstrate our Molding Magic right before your eyes.

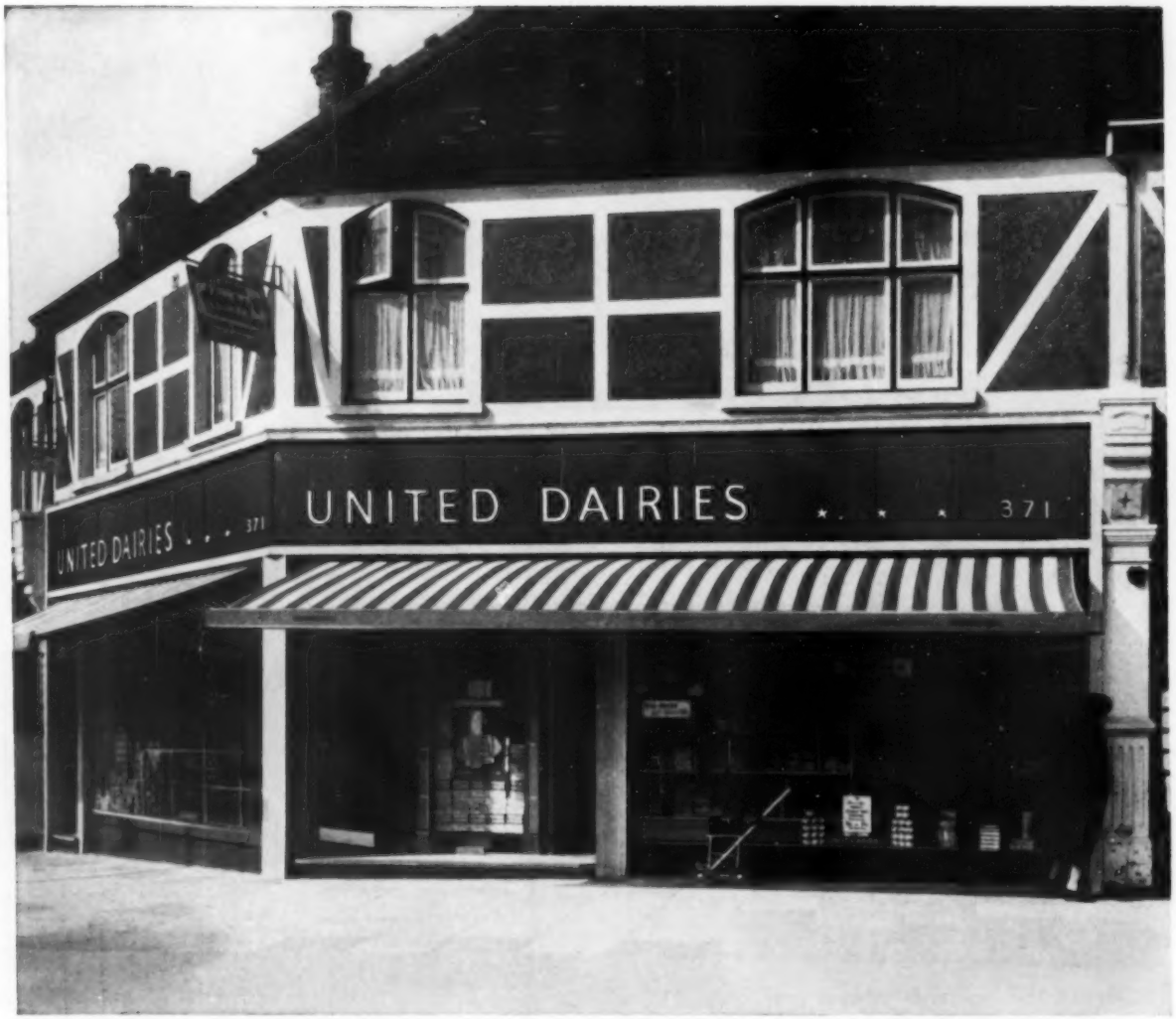
Write or call for detailed data or an appointment

THE AKRON PRESFORM MOLD CO.

Phone WA 8-2105

2044 Main Street, Cuyahoga Falls, Ohio

FORMS	MOLDS	DIES	MACHINERY
LATEX DIPPING	STEEL AND ALUMINUM	PLASTIC INJECTION	SPECIAL AUTOMATIC



Red 'Perspex' was used for the facia of this English United Dairies Shop and also for panelling around the door. Architect F. T. Dear, F.R.I.B.A., Contractors C. Oliver & Son (Builders) Ltd., Subcontractors: Fredrick Sage & Co. Ltd.

'Perspex' makes a good name stand out

'PERSPEX' is the ideal plastics material for shop facias. It is tough and good-looking and will give excellent service. It has, indeed, stood the test of time, both indoors and out. 'Perspex' is available in clear and opal sheet or in a wide range of transparent, translucent and opaque colours. It combines lightness with strength and transparency, which gives it special value in many situations. 'Perspex' is so easy to shape and form that it encourages novelty in design.

'PERSPEX'

'Perspex' is the registered trade mark for the acrylic sheet manufactured by I.C.I.

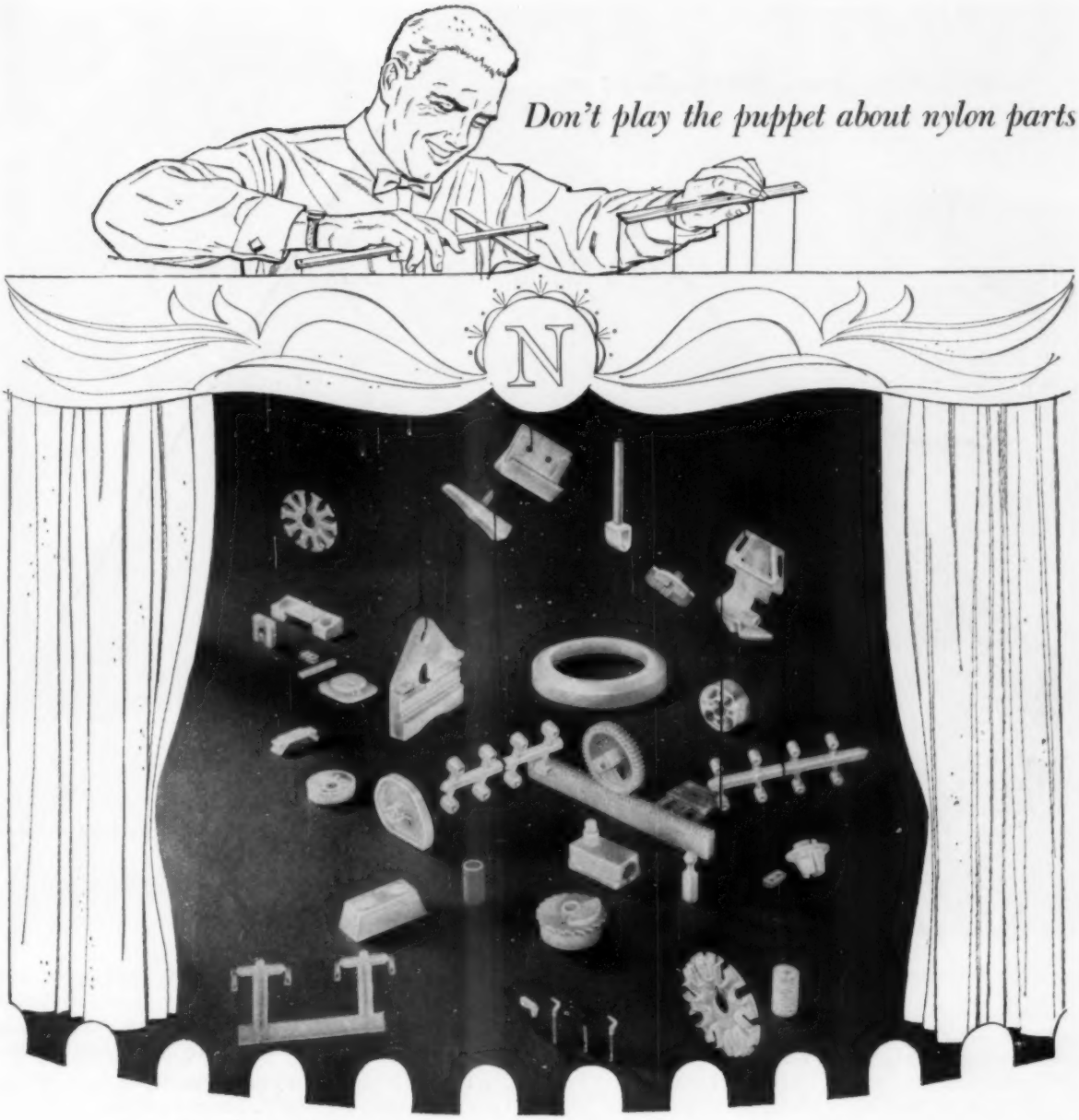
IMPERIAL CHEMICAL INDUSTRIES LIMITED,
PLASTICS DIVISION: EXPORT DEPT., BLACK FAN ROAD, WELWYN GARDEN CITY, HERTS.

U.S.A. enquiries to: J. B. Henriques Inc.,
521 Fifth Avenue, New York 17, N.Y.

Canadian enquiries to: Canadian Industries Ltd.,
Plastics Dept., Box 10, Montreal, P.Q.

ICI

P644/0/A



NOSCO "CAN DO" KNOWS NYLON MOLDING

Don't be misled by assuming that just any injection molder can mold nylon. It's an art and requires much skill and experience. Apply this 5-point test to qualify your potential nylon molders:

1. Do you know how to design molds to compensate for temperamental nylon shrinkage?

2. Does your gating control the behavior of nylon—for uniform fill, for optimum physical properties, for minimum waste of this costly material?

3. Do you have specialized machinery for molding nylon? Non-drool nozzles?

4. Do your heating cylinders provide sufficient stages for complete plasticizing without scorching?

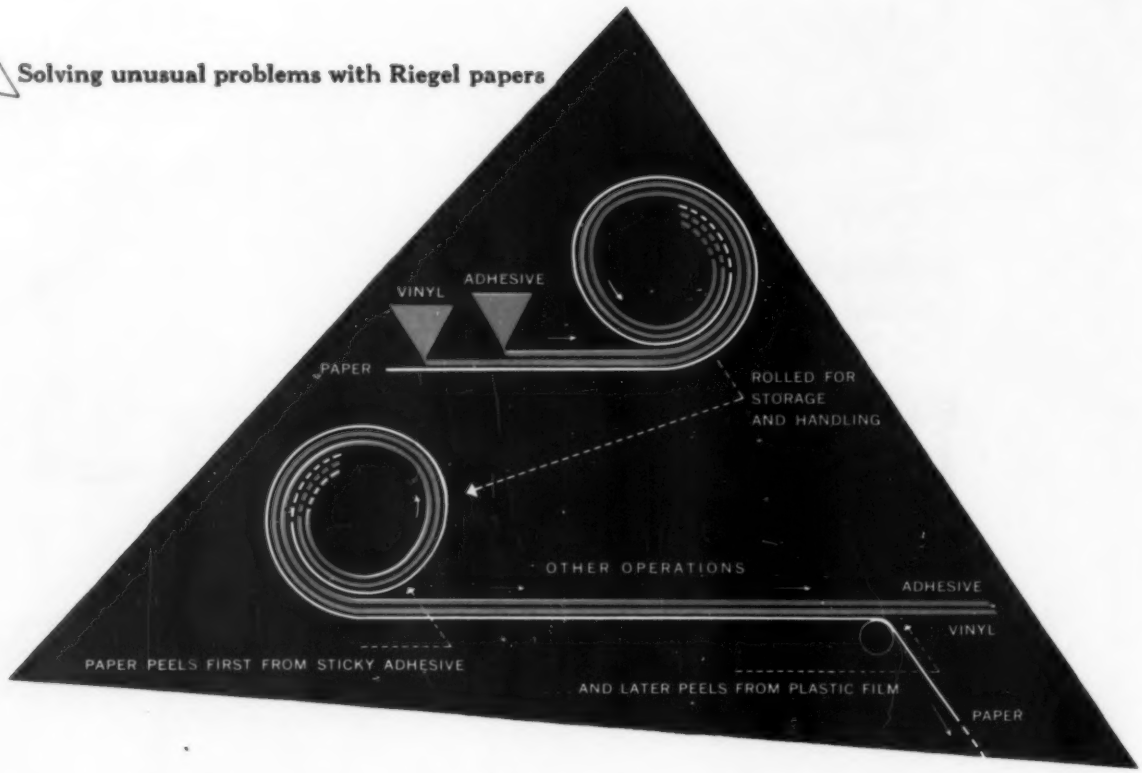
5. Do you normalize after molding?

The one molder who can answer all of these questions with an emphatic "yes" is NOSCO—with more than 12 years of "can do" nylon molding experience.

It will pay you to have Nosco "Can Do" quote on your molded nylon parts. Why not write?

NOSCO plastics, inc. • erie 5, pa. *World's largest injection molding plant*

Solving unusual problems with Riegel papers



Plastic Casting Paper and Release Paper... all in one!

An idea . . . and a search for a paper that didn't exist . . . recently brought a leading manufacturer to Riegel. Wanted: a paper that would serve as casting paper for plastic film and release paper for pressure-sensitive adhesive . . . *all in one!*

Riegel's developmental team went to work. Drawing on wide experience in plastic impregnations, coatings, and manufacture of unique technical papers, they soon came up with a special release-coated paper that makes the job easy! Here's how it works:

The film of vinyl is continuously cast on the top of the paper and cured at temperatures over 400°F. The paper serves as a carrier while the adhesive is applied to the vinyl. The whole thing, paper, plastic, and adhesive, is then rolled for storage.

Later, when the roll is unwound, the release-coated *back* of the paper peels easily from the sticky adhesive, with such a light pull that the adhesive-coated vinyl film remains on the base paper where it was cast. Yet a few steps later, the plastic itself strips cleanly from the paper. We've named it a *differential* release paper.

Riegel specializes in developing, manufacturing and converting *technical papers that solve problems.* More than 600 kinds . . . many with properties that will intrigue you . . . have already been produced on our 14 paper machines. If you have an idea for doing something in a better way . . . with a better paper . . .

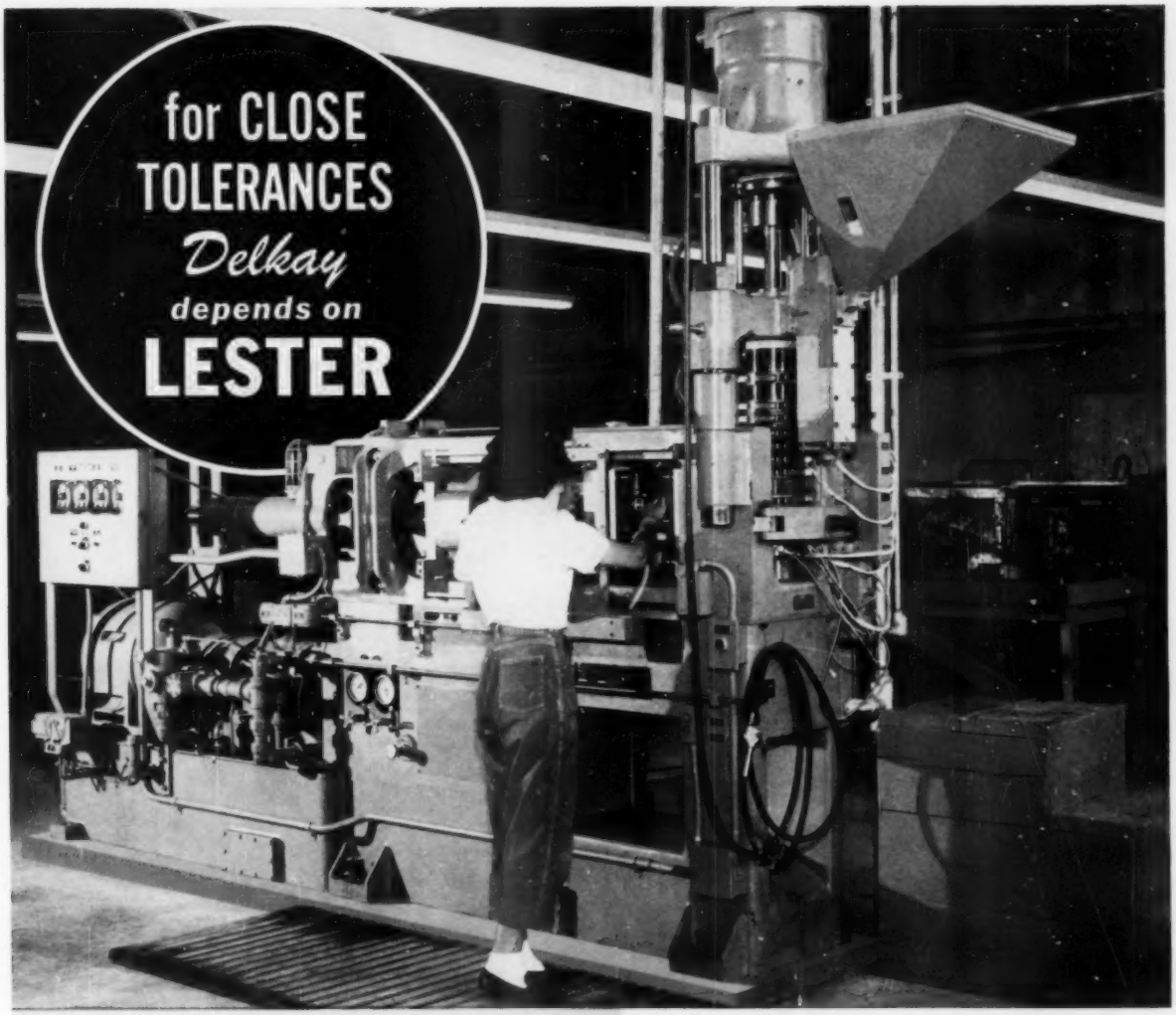
OVER 600 RIEGEL PAPERS

- Release papers for pressure sensitive adhesives
- Casting papers for films, adhesives and polyurethane foam
- Separating papers for plastic laminating
- Interleaving papers for tacky materials
- Resin-impregnated papers
- Heat-seal coated papers
- Laminations of paper, film or foil
- Polyethylene extrusions on paper, film or board

Riegel

.....write to: **Technical Advisory Service**
Riegel Paper Corporation
Box 250, New York 16, N.Y.

TECHNICAL PAPERS FOR INDUSTRY



Delkay Plastics Corp. of Gardena, Cal. says:

"The nylon parts shown are molded for Cannon Electric Company, the world's largest manufacturer of multi-contact electrical connectors, with a reputation for highest quality and reliability. The reliability is extremely important. It might mean the difference between a Vanguard in the air or on the ground. Therefore, here at Delkay, we must adhere to extremely close tolerances in both thin walled and heavy walled sections and in multiple cored parts.

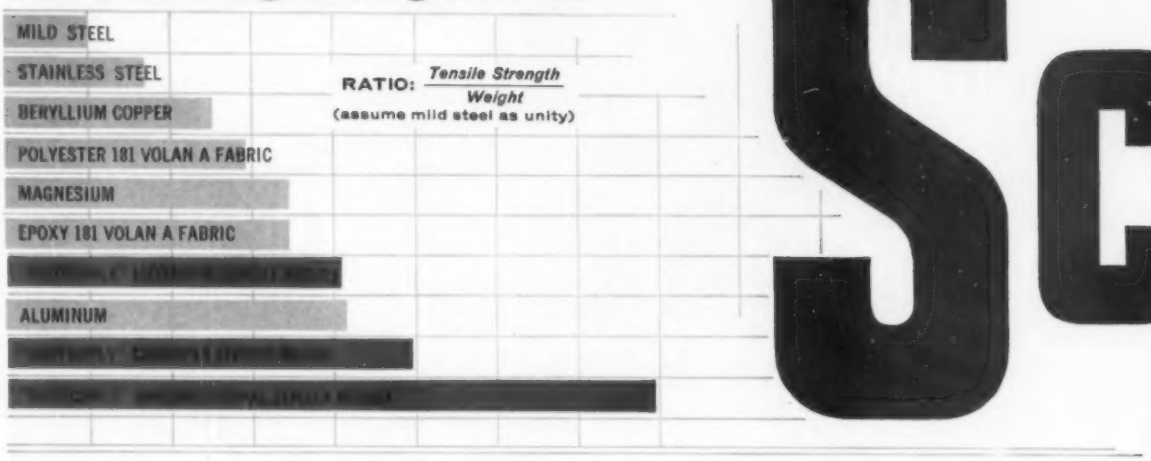
"Our new 4-Ounce Lester machine enables us to meet these specifications while eliminating drool and the resulting 'strings' and also through the elimination of freezing at the nozzle. The result is a savings of both time and materials. The Lester performance is beyond our expectations."

LESTER-PHOENIX, INC.

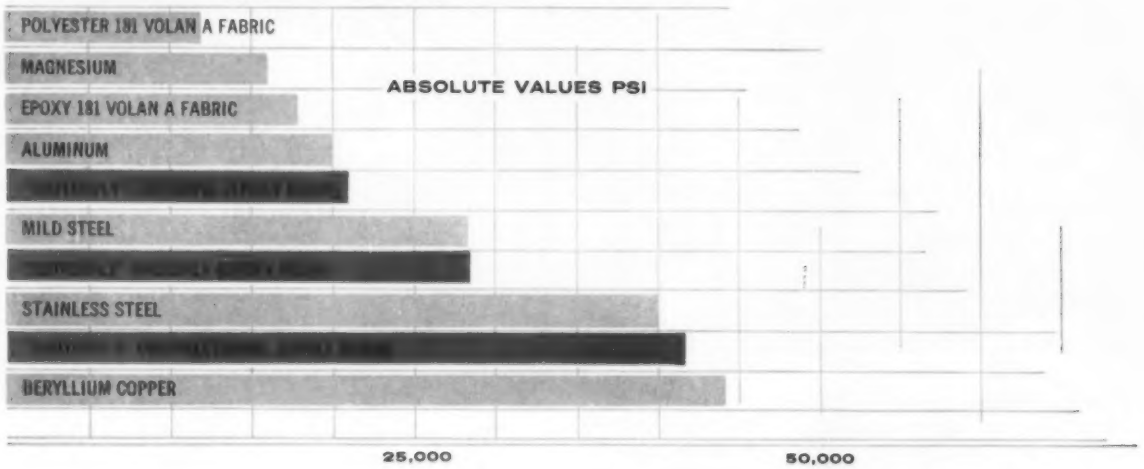
2621-A CHURCH AVENUE • CLEVELAND 13, OHIO

Agents in principal cities throughout the world

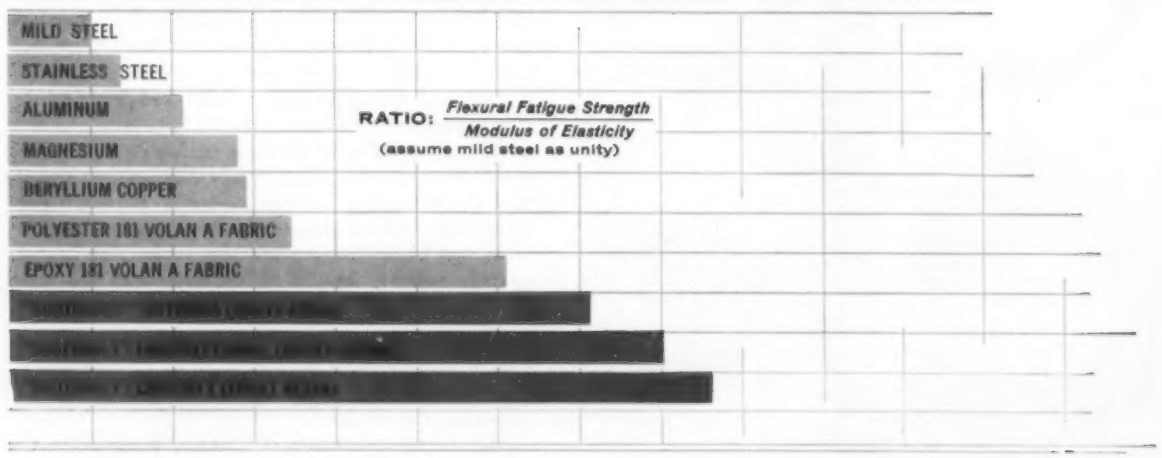
Tensile strength-weight ratios



Flexural-fatigue strength @ 2 x 10^6 cycles



Allowable flexural-fatigue deflection @ 2 x 10^6 cycles



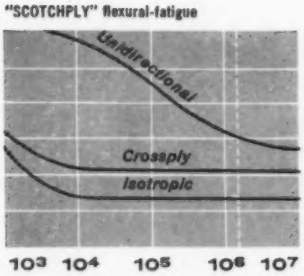
REG. U.S. PAT. OFF.

SCOTCHPLY

BRAND **REINFORCED PLASTIC**

A revolutionary structural material offers a unique combination of properties

"SCOTCHPLY" flexural-fatigue



Looking for a structural material with a superior strength-weight ratio *and* exceptional fatigue strength? You get it—and more—in "SCOTCHPLY" Brand Reinforced Plastic.

"SCOTCHPLY" Reinforced Plastic is a moldable, laminated plastic reinforced with *continuous non-woven* glass filaments oriented to your specific stress requirements. It is available in epoxy, phenolic and other resin formulations. You get a combination of properties unlike any other structural material on the market.

Compare "SCOTCHPLY" Reinforced Plastic to other structural materials in the graphs on the opposite page. Look at the tensile strength-weight ratios. Then check the fatigue strengths and allowable flexural-fatigue deflections (taken at an arbitrary 2 x 10^6 cycles from the S-N curves shown reduced at left). Valuable combinations? You bet.

And that's not all. "SCOTCHPLY" Reinforced Plastic has excellent resistance to corrosion and water absorption, low thermal conductivity, low notch sensitivity, good puncture and dent resistance. It is sold in uncured sheets or rolls containing a controlled ratio of glass to resin. Heat and light pressure in matched metal dies, vacuum or pressure-bag molding cure it into rigid form. It can then be sawed, machined, sanded, milled, turned, drilled or tapped.

FOR COMPLETE INFORMATION and technical service, write on your letterhead to Dept. G.G., Reinforced Plastics Division, 3M Co., 1210 University Ave., St. Paul 4, Minn. A "SCOTCHPLY" Reinforced Plastic reference manual will be mailed you without charge.

Continuous, non-woven glass filaments are resin-bonded and oriented in... unidirectional... crossply... isotropic form... or combinations to meet your needs.

"SCOTCHPLY" IS A REGISTERED TRADEMARK OF THE 3M CO., ST. PAUL 6, MINN. EXPORT: 99 PARK AVE., NEW YORK 16, N. Y. CANADA: LONDON, ONTARIO

MINNESOTA MINING AND MANUFACTURING COMPANY

. . . WHERE RESEARCH IS THE KEY TO TOMORROW

3M COMPANY

The new Hamilton steam platen press pictured above is the fourth to be installed at Formica Corporation's Evendale plant. Each press is capable of developing pressures of more than 4500 tons over a 4 x 10 ft. surface.

Baldwin steam platen presses serve the nation's laminating industry

Baldwin Steam Platen Laminating Presses may be found in virtually every one of the nation's modern laminating plants. To name but a few of them: Formica Corporation, General Electric, Westinghouse, Continental Diamond Fibre Company, Synthane Corporation, Parkwood Laminates, Inc., National Plastic Products Company, Panelyte Division of the St. Regis Paper Company, Spaulding Fibre Company, Richardson Company, Taylor Fibre Company.

The extreme rigidity of Baldwin presses assures continued maintenance of the desired parallelism between the plates, a feature which is achieved in manufacture by testing with fuse wire at frequent intervals across the surfaces—and taking many micrometer readings. Average variation from true must not exceed .003 in. Write Dept. 15H for details.

Hamilton Division Hamilton, Ohio

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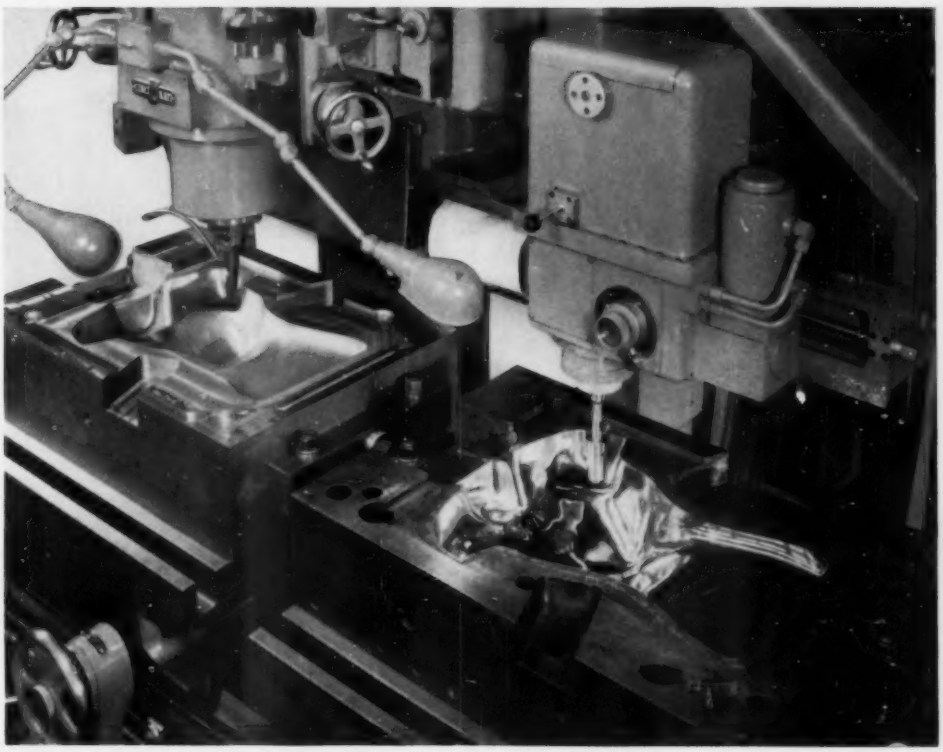
Diesel engines • Mechanical and hydraulic presses • Can making machinery • Machine tools

BALDWIN BLH LIMA-HAMILTON

LIFE-SIZE DRESS FORM MOLDS . . .

milled complete in 42 hours

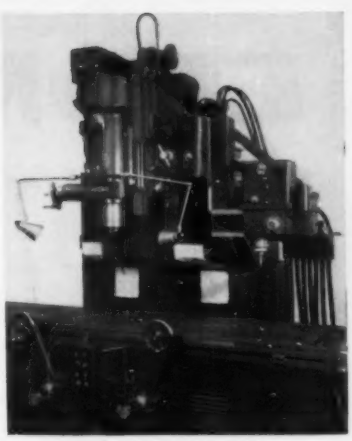
on CINCINNATI 28" Vertical Hydro-Tel



Life-size dress form mold, milled complete in one setting, on a CINCINNATI 28" Vertical Hydro-Tel Milling Machine.

CINCINNATI

Starting with a solid block of die steel, the life-size dress form mold in the above illustration is machined complete in only 42 hours! This includes the parting face, gates and mold cavity. And the entire job is accomplished in one setting. Hard to believe? It's one of the actual jobs milled on a CINCINNATI 28" Vertical Hydro-Tel Milling Machine, equipped for combination automatic depth and 360 degree tracing. ¶ These machines reduce die and mold costs in two ways. 1) They are ruggedly constructed to remove metal rapidly. For example, the Hydro-Tel for the above job (96" table travel) weighs about 15 tons, and is equipped with a 10 hp spindle drive motor. 2) They take extra smooth cuts in the mold cavities, thereby reducing hand finishing costs to a minimum. The tracing finger automatically scans shallow and deep cavities alike, with the smoothness inherent only in Cincinnati's hydraulic tracing. ¶ Many tool and die shops are machining molds and hobs of all sizes and shapes on CINCINNATI Hydro-Tel Milling Machines. And because of Cincinnati equipment, their costs are lower. ¶ See what Cincinnati has for your tool and die work. The complete line is illustrated and described in general catalog No. M-1961-1. Get a copy today.



CINCINNATI 28" Vertical Hydro-Tel Milling Machine. Catalog No. M-1773-2. Brief specs in Sweet's Machine Tool File.

THE CINCINNATI MILLING MACHINE CO., CINCINNATI 9, OHIO

CINCINNATI®

Knee Type Milling Machines • Bed Type Milling Machines • Die Sinking Machines • Cutter and Tool Grinders

EPON® RESINS

Photographs courtesy of Jack & Heintz, Inc. and Freed Transformer Co., Inc.

are preferred for potting, sealing and encapsulating!

Epon resins are the number 1 choice for potting, laminating, sealing and encapsulating, because they provide an almost perfect combination of electrical and physical properties.

Potting and Encapsulating. Epon resins possess outstanding adhesive qualities . . . form strong bonds to metal and glass. They assure an air-tight enclosure for delicate components and vacuum tubes. Even when exposed to solder bath temperatures, Epon resin retains its dimensional stability.

Sealing. Epon resin-based insulating varnishes and potting compounds provide excellent moisture sealing. They offer outstanding resistance to solvents and chemicals even at elevated temperatures.

Epon resins also produce base laminates of superior dielectric properties when laid up with inert fibrous fillers. These laminates can be sheared, punched, drilled, and bath-soldered.

For complete information on Shell's family of Epon resins, write us now.

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SHELL

The Plastiscope*

August 1958

News and interpretations of the news

By R. L. Van Boskirk

Section 1

Cosden's price schedule. Considerable interest has been stirred up in the industry by Cosden Petroleum Corp.'s pricing system which was initiated when the firm's new 22 million-lb. polystyrene polymer plant came on stream last month. The company is making deliveries in 34,000-lb. trucks with pneumatic unloading devices to molders who are equipped to handle bulk quantities.

The price is based on a zone system and depends on the distance of the purchaser from Big Spring, Texas, where Cosden is located. The prices on current deliveries will be discounted as accumulated purchases reach a certain volume during the contract period. All deliveries after the first 399,999 lb. would be discounted at ½¢—after 799,999 lb., the discount is 1¢/pound. There are six zones, the first of which includes a radius of 100 miles from Big Spring; the sixth includes a radius of 901 to 1100 miles.

Price in the first zone for general-purpose polystyrene is 21¢ and 28.75¢ for impact; the second zone (Dallas, Austin), 21.35 and 29.10¢; the third zone (Houston, Tulsa), 21.65 and 29.40¢; the fourth zone (Kansas City, Memphis), 22.15 and 29.90¢; the fifth zone (St. Louis, Des Moines), 22.45 and 30.20¢; and the sixth zone (Chicago, Los Angeles), 22.75 and 30.50 cents. It should be noted that the discount of ½ or 1¢ is subtracted from this price on that part of the accumulated amounts that exceed a 400- or 800-thousand-lb. quantity during the contract period. This system is somewhat similar to the industry's price arrangement, set up right after World War II, that was based on distance of delivery from the producer's plant but was later abandoned for the present F.O.B. system.

A Cosden official states that he believes the zone price reductions will benefit molders who are located in the less heavily populated marketing areas by helping to absorb some of the extra freight charges when he ships finished products and that Cosden will be gratified if this price system contributes to the growth of the molding industry in the Southwest.

Phenolic resin price reduction. The Durez Plastics Div., Hooker Chemical Corp., has reduced prices 2¢/lb. on four general-purpose and two heat-resistant phenolic compounds as well as 1¢/lb. on four closure-type compounds. The first six compounds are 740 and 791 brown and black standard general-purpose; 792 and 16038 black and brown general-purpose that have a more rigid set; 1308 asbestos-filled black; and 16744 asbestos-filled black with a little higher impact. These resins are now 19½¢ in truck load quantities compared with the former price of 21½ cents. The four closure-type resins in brown and black are now 20½¢ in contrast to the former 21½ cents. The closure

*Reg. U.S. Pat. Off.

masters in the field of

COLOR*

The rich flesh tones he's justly famous for or the vivid red of a tunic . . . whenever *Peter Paul Rubens applied pigment to canvas, it was the "just right" color, mixed by a master hand.

Rubens' – "The Fox Hunt" (detail)

For over ten years, WESTCHESTER PLASTICS has been following in the spirit of the old masters. For every purpose, for every product, there's a "just right" color and Westchester prepares it with a master's touch. Take our pre-matched color concentrate for linear polyethylenes, for example. It's custom-tailored for this dramatic development of the plastics industry . . . eliminates degrading, migrating and leaching, gives improved temperature and chemical resistance.

Every product in the WESTCHESTER line is the result of our years of pioneering experience, exclusively in the field of color for polyethylene and other thermoplastic materials. Write today for more information on our master-compounded concentrates. Find out how Westchester's complete color service can help you give *your* product masterpiece quality.

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Manufacturers and Developers of Unicolor and Formacolor

*Pliathane, Formacolor, Unicolor® T.M. Reg. U.S. Pat. Off.

The Plastiscope

(*Continued from page* 37)

materials are one-step resins and as such command a slight premium in return for minimum odor and bleed.

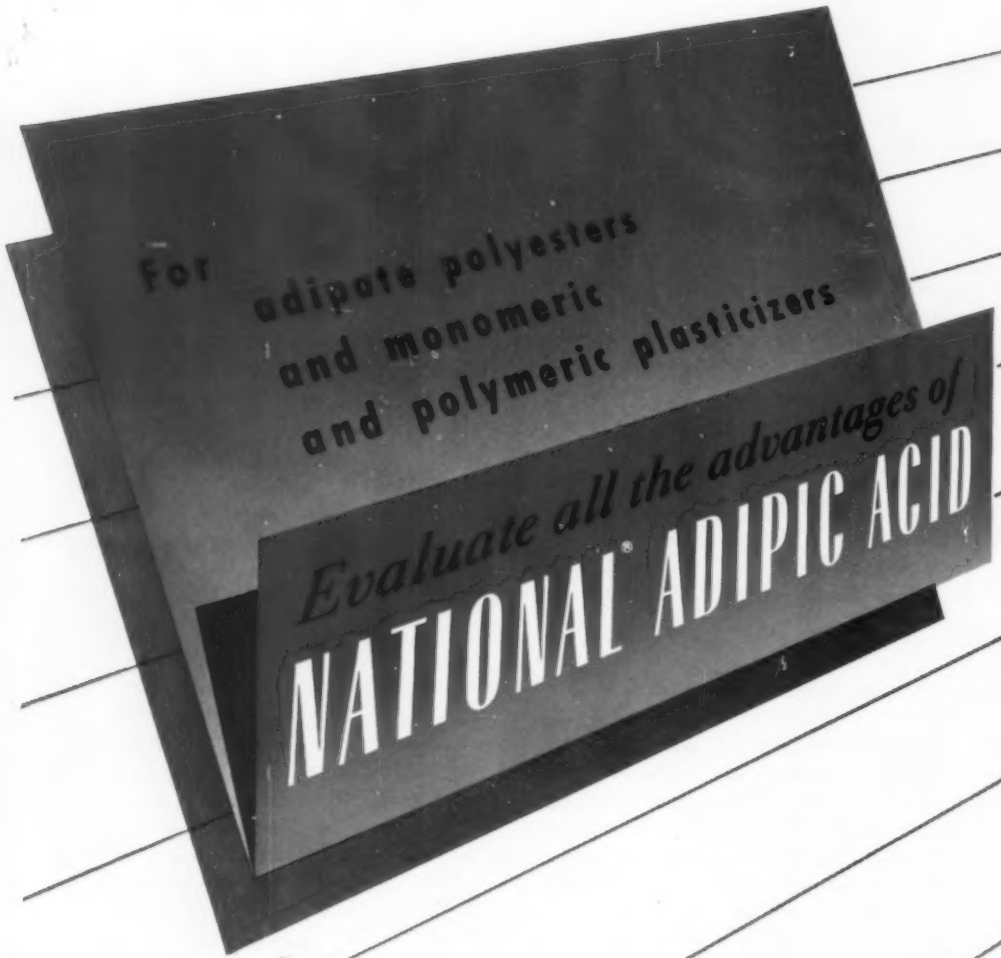
A. W. Hanmer, general sales manager of Durez, believes that the reduction in price of these most widely used phenolics should encourage molders to limit the number and variety of compounds used and thus simplify their operations. Mr. Hanmer believes that most applications can be satisfactorily molded from one of the resins named above and a Durez technician will be available to help molders change over. If Durez succeeds in this effort to cut down the multitudinous volume of formulations used in the phenolic industry, it will be a major event in history. Durez claims to be in a good position for initiating such a move because of its new automated plant at Kenton, Ohio, where long runs on one type compound would be particularly advantageous in savings that could be passed on to the molder.

Monsanto drops phenolic molding compounds. The announcement that Monsanto would cease production of phenolic molding compounds created some eyebrow lifting in the industry, but officials of the company assert that they can use manpower and physical assets formerly employed in phenolic molding powder operations to better advantage in other areas. Phenolic resins, other than molding powder, will continue to be produced by Monsanto. Clark Richards, formerly manager of phenolic m. p. sales, will become assistant to Edward Hobson, director of plastics sales. Total industry sales of phenolic m. p. resins have leveled off at between 170 and 200 million lb. per year since 1954, after many years of violent fluctuation, and market analysts are loathe to forecast unusual growth unless some sensational application, such as television cabinets of post-Korean war days, should develop.

Vinyl chloride price drop. The decline in the price of general-purpose vinyl chloride resin from 27 to 25¢ has created considerable talk concerning its effectiveness. A majority opinion, however, holds that the 2¢ reduction has helped to stabilize the price structure.

The reduction was reportedly initiated to calm the complaints of customers who told their regular suppliers that they were getting offers of Grade A resin at well below the 27¢ price. Proof of the effectiveness of the reduction is that most of the complainants are now buying the 25¢ resin without quibble. Material producers believe that around 90% of all the Grade A general-purpose resin is now selling at the 25¢ price and that most of the so-called "market" for lower cost Grade A resins is built on talk from certain customers who quote imaginary price offers in the hope that their supplier will lower his price.

Of course, there will be some deviations from the standard price. Industry is always affected by severe price bickering in periods of recession and some competitors always turn to price-cutting when competition gets tough. And since the sales volume of the industry is today running at about a 550 million-lb. annual rate and has over a 900 million-lb. capacity, there is certain to be some extra-fine pencil sharpening in an industry in which there are now 19 suppliers. Furthermore, there is a great quantity of off-grade or B



If you use or contemplate using Adipic Acid in elastomers, plastics, plasticizers, synthetic lubricants or as a chemical intermediate, we urge you to get a working sample and quotation from National Aniline.

Our product quality has been found outstanding by many substantial users. Strength is 99.8% minimum with low moisture, iron and volatile acids.

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Allied Chemical

The Plastiscope

(*Continued from page* 39)

Grade resin on the market as well as low cost specialty resins sold for the calendering, floor covering, garden hose, secondary wire coating, and some profile applications. But these resins have always been sold at lower than the standard price. However, high-quality goods such as wire coating that meets Underwriter's specifications can't be produced from off-grades.

Rumors of cost-slashing will continue and customers will continue to try to play off one supplier against the other, but most of them are probably going to pay that 25¢ price for Grade A resin for some time to come. Incidentally, the price for plastisol grades was reduced from 30 to 28¢ to meet the competition from calendering resins for cloth coating. The 30¢ price on copolymer resins for records remains as it was, and the price for resins used in unplasticized compounds is still 37 cents.

Du Pont sues on polyethylene patent. Du Pont has filed suit in the U. S. District Court for Delaware against Phillips Petroleum charging the latter with infringing a composition of matter patent on linear polyethylene awarded Du Pont Dec. 17, 1957 by the U. S. Patent Office. (See M. PL., p. 35, Feb. 1958.) Phillips has replied that in their opinion there is no infringement.

Vinyl stearate plant in production. Air Reduction Chemical Co.'s new 2 million-lb.-capacity vinyl stearate plant at Calvert City, Ky., is now in production. Vinyl stearate is not new, but it has never before been plentiful in commercial quantities. It is now available at 65¢ a lb. compared to a former price for laboratory material of $1.50 a lb. It is produced from stearic acid and either acetylene or vinyl acetate. The stearic acid is derived from either animal fats or soy beans. ARC has low-cost acetylene available at Calvert City as well as its own vinyl acetate. Technicians have been at work with vinyl stearate for years in an endeavor to use it as an internal plasticizer for both vinyl chloride and vinyl acetate to produce a flexible material and thus obviate the necessity for using migratory plasticizers, but ARC technologists believe that lack of availability and high cost have prevented a thorough study.

An idea now prevalent is that the cost can be reduced when used as a copolymer with vinyl chloride by limiting the vinyl stearate content to only 5 to 15% of the total weight of a chloride-stearate copolymer. A DOP or similar plasticizer would then be necessary, but only in much smaller quantities than are currently used. The stearate would still give easier milling properties to the copolymer and improve its water resistance and electrical properties over conventional highly plasticized vinyl chloride. In addition, the lower milling temperature would help eliminate some of the heat degradation that takes place during extrusion. It would still be higher in cost than conventional plasticized PVC, but for specialty applications such as some types of wire coating it would be superior.

Vinyl stearate is also suggested as a copolymer with vinyl acetate for paint resins. Its lower brittle point would extend the life of the paint film and there would be no plasticizer to migrate. Indications are that a content of 8 to 10% vinyl stearate in the copolymer will give the equivalent properties of the 20 to 30% content of the dialkyl fumarates and maleates now used as

AMOCO CHEMICALS—A NEW RESOURCE

Have something to say about the raw materials used in your plasticizers

Phthalate-type plasticizers—DIOA, DDP, DDA, DIOP—made from Amoco Oxo Alcohols are lighter in color and more stable. This is possible because with these Alcohols, esterifiers are starting with the highest quality raw materials. How come? Because Amoco Oxo Alcohols must meet specifications that are setting a new industry level for minimum ester color.

Getting better finished vinyls and improving processing can result from checking the quality of the raw materials used in plasticizers that you buy.

AMOCO CHEMICALS

AMOCO CHEMICALS CORPORATION
910 South Michigan Ave., Chicago 80, Illinois

The Plastiscope

(*Continued from page* 41)

the second monomer in vinyl acetate and thus save cost while giving improved properties in the finished product.

Other suggested uses for vinyl stearate are with styrene to produce an impact material; as a viscosity index improver with vinyl chloride for lubricating oils; with vinyl acetate for chewing gum, paper coatings (increasing wet strength), and textile finishes; with vinyl chloride for adhesives, metal coatings, and phonograph records; and with styrene and maleic for ion exchange resins. The homopolymer as a wax with high solubility in mineral spirits shows promise for use in wax and polish formulations, especially those intended for aerosol application.

New vinyl foam. An extruded vinyl foam produced from standard Geon resin by Carolina Industrial Plastics Division, Mount Airy, S. C., a division of Essex Wire Corp., Ft. Wayne, Ind., could be an entrant for "plastics of the year" award if such an award were to be granted. Called "Cipco Foam," it is produced in continuous length extrusions with a uniform, small cell structure and a controlled mixture of open and closed cells. Its cellular construction results in a material which does not "bottom" under sudden impact. Its age resistance may be greater than rubber and it gives an air-lock effect for insulation.

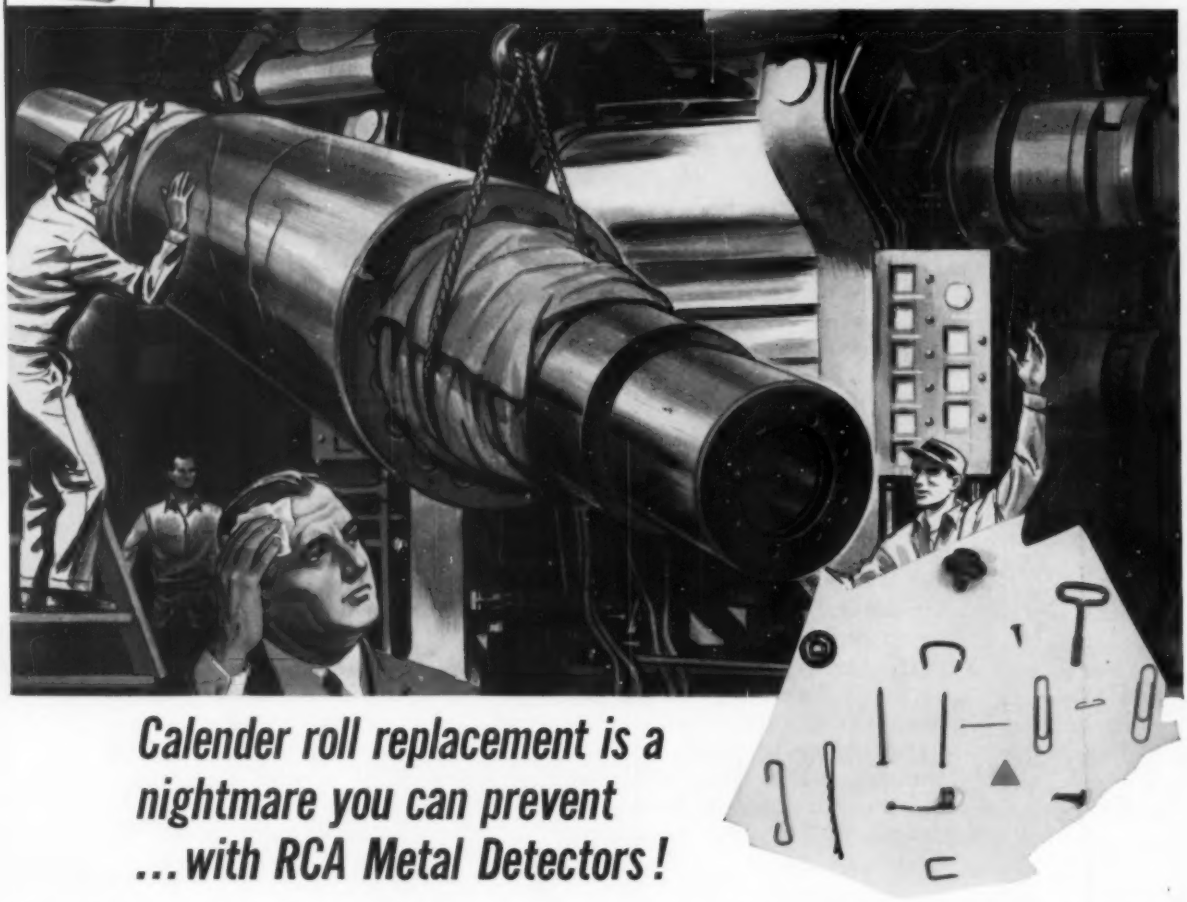
Some suggested uses for the new foam, in addition to wire coating, are automotive windlacing around doors, insulation at bottom of storm doors, bumper strips on garage doors, and wherever seals are needed for uneven surfaces such as those where heads of fasteners are present; Cipco flows around protrusions. Its density is 12 lb. per cubic foot and tensile strength is 108 p.s.i. It is available in a standard line of round lengths with diameters of from ⅛ to 1 inch.

Thick sheets of PVC. In the June Plastiscope an item called attention to a ⅛-in. thick unplasticized PVC sheet, 52 in. wide, produced from a new die by B. F. Goodrich Chemical Co. and National Rubber Machinery Co. A letter from Joseph T. Ryerson & Son, Inc., of Chicago, Ill., states that this company, in conjunction with Corroplast, Inc., has been producing a 40-in. sheet in thicknesses up to ¼ inch for two years under the trade name of Ryertex-Omicron. It is interesting to note that extruded, unplasticized PVC of this heavy gage is on the market, but an important factor of the previous announcement was the extreme width of 52 in., since 40 in. had formerly been regarded as the ultimate width for extruded unplasticized PVC.

New nylon plant in full production. Foster Grant Co., Inc. reports that its new nylon plant in Manchester, N. H., is now producing at an annual rate in excess of 3 million pounds. The company has also made a licensing agreement with Dansk Plastics of Denmark which permits Foster Grant to use that company's processes for casting large shapes, rods, and tubes.

For additional and more detailed news see Section 2, starting on p. 204.

...GATEWAY TO SAFETY FROM TRAMP METAL



Calender roll replacement is a nightmare you can prevent ...with RCA Metal Detectors!

If the above picture was only a "bad dream," it wouldn't be worth discussing. Unfortunately, tramp metal damage to calenders DOES cause shutdowns in plastics plants. When this is the case, the loss of production is staggering, not to mention the cost of replacing or regrinding damaged roll! A well-known processor says, "Over the years RCA Metal Detectors have saved us tens of thousands of dollars in detecting foreign matter in our raw products which could damage our calenders. We feel the Detectors are cheap at any price."

Used on strip material traveling at speeds from 15 to 1000 ft. per min., with full inspection sensitivity, the Detector can be arranged to sound an alarm, and/or stop the traveling material. In plant after plant, the RCA Electronic Metal Detector has paid for itself many times over through increased life of costly machinery, decreased downtime, and savings in product. It can be put to work quickly in *your* plant.

Find out today how the RCA Metal Detector can save you money. Write for latest literature, RCA, Dept. J-75, Building 15-1, Camden, N.J.

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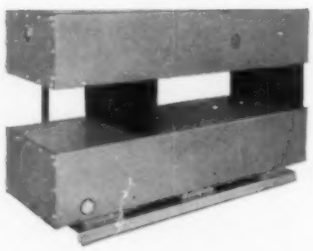
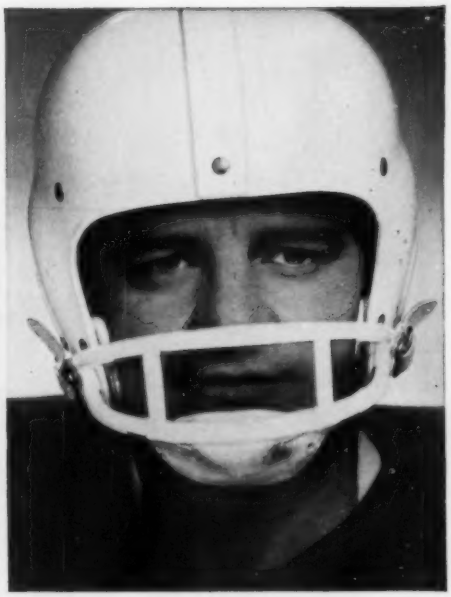


RCA ELECTRONIC METAL DETECTOR

"See how much easier this flexible guard goes on!" John DePaulis (left) demonstrates to John Cowden the extra benefits of the Marietta football face guard, made from Spencer Nylon.



Better vision, too. Because Spencer Nylon is metal-tough as well as plastic-light, even thin guards give good protection.

More Flexible Nylon Solves Molding Problem

Special properties of Spencer Nylon give Texas product needed extra flexibility plus metal toughness . . .

A perplexing problem recently faced Dr. M. T. Marietta, a Texas dentist and manufacturer. Dr. Marietta had a molding problem requiring a material that was both flexible *and* tough. In addition, the material had to be lightweight and easy to mold. The solution he found may help you, too.

His problem began the day that Texas Christian University's star back, Lindy Berry, broke his nose and jaw in football practice. Soon after that, Berry appeared in the office of Dr. Marietta. Berry intended to play the season out, he declared, and he wanted a protective guard for his broken bones. For this emergency, Dr. Marietta produced a hand-made face mask. With it, Berry not only played out the season, but also made All-American. This was the beginning of what is now known as the Marietta Safety Mask Co., of Dallas.

Most face guards of the past were steel, dip-coated with rubber. They were impractical and often dangerous. Guards made of other plastics were so rigid that it was often hard to pull off the helmet without practically disjointing the player's ears. Then Dr. Marietta thought of nylon. He first tried an earlier-type nylon, but found the samples still too rigid.

The final answer turned out to be new, easy-to-mold Spencer Nylon. Dr. Marietta finds Spencer Nylon flexible, lightweight and durable under playing conditions. He reports less breakage with nylon than with any other materials. With Spencer Nylon, he can make guards that are slim, smooth and attractive.

Players can see better, too, through these slimmer guards. Also, because Spencer Nylon is easy to dye, schools can have these bars dyed in their own school colors. And the superior design of the guard makes it easy to install on the helmet.

The company started to make molds for Spencer Nylon face guards in November, 1957. The first guards came off in February. By the first of May, the firm was behind in their orders. General Manager John DePaulis believes the volume may amount to 100,000 the first year. In fact, such gear may soon become compulsory for all football teams.

Your special needs may also find an ideal answer in Spencer Nylon. For complete information write: Spencer Nylon, Spencer Chemical Co., 516 Dwight Bldg., K. C. 5, Mo.

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Cycolac Sheet Extruded and Formed by: Panelyte Division, St. Regis Paper Company, Richmond, Indiana

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This family of single uniform resins is extremely tough and versatile; extrudes readily, in profiles and sheets; easily injection molded and post formed.

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- Fast extrusion to accurate dimensions
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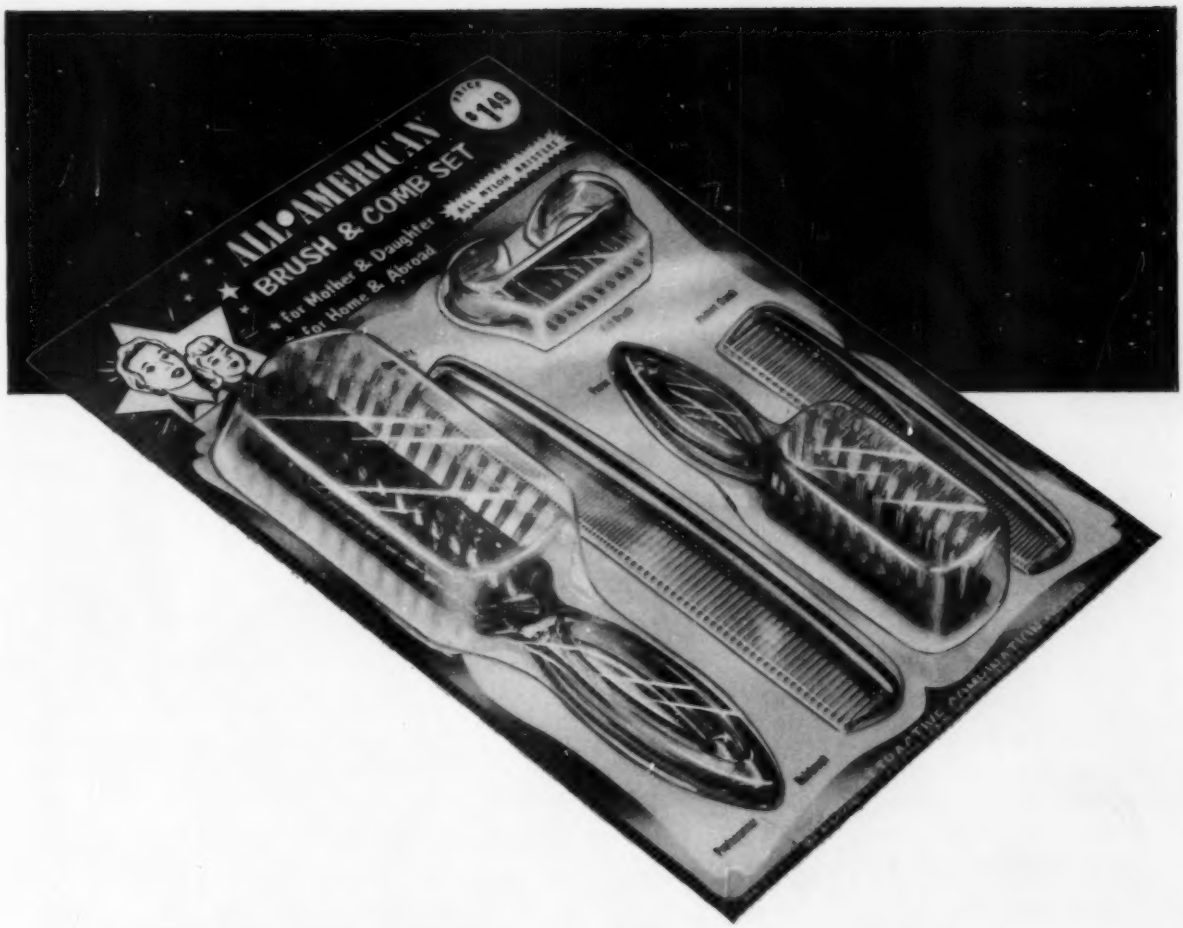

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the perfect plastic material for blister packaging. JODA extruded acetate sheets, rolls and film in light to heavy gauges — translucent, transparent or opaque — are excellent for vacuum forming. TRISONIA PLASTICS, New York City, have made good use of this versatile material in the smart packaging shown here. Wise merchandisers know that blister packaging is the packaging of the future, and the use of JODA crystal clear acetate is assurance that the product will be seen — and sold.

BUTYRATE and LINEAR POLYETHYLENE available in standard sizes.

For information and samples, contact

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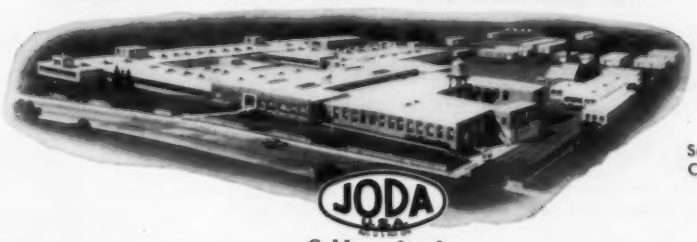

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REMARKABLE TOUGHNESS. "Mylar" is the strongest flexible plastic film ever made... tough even in extra-thin gauges. "Mylar" has high dielectric strength... resists abrasions.

RESISTS CHEMICALS & MOISTURE. "Mylar" is unaffected by oils and grease . . . resists most acids, alkalies and solvents. "Mylar" is moistureproof . . . dimensionally stable.

How Du Pont Mylar® helped make possible a new, better-performing drafting film

Thanks to the remarkable combination of properties found in versatile Du Pont "Mylar"* polyester film, leading manufacturers of engineering materials are now offering new, more durable pencil and ink drafting films that help safeguard investments in time and labor.

Because of "Mylar", these new drafting films resist handling wear and tear . . . deterioration from aging, cracking, heat and moisture . . . remain flexible even after years of storage. Yet, while offering permanent protection for valuable drawings, drafting films made with "Mylar" *cost no more* than many grades of drafting cloth!

HOW CAN "MYLAR" HELP YOU? Drafting film is just one of many new and improved products now made with "Mylar". For example, "Mylar" is also an efficient electrical insulator . . . a base for a tougher, more durable magnetic tape. *You* may be able to capitalize on the outstanding combination of properties found in "Mylar". For all the facts, write E. I. du Pont de Nemours & Co. (Inc.), Room M-8, Wilmington, Del.

*"Mylar" is a registered trademark for Du Pont's brand of polyester film. Du Pont makes the base material "Mylar"— most leading manufacturers of drafting materials are now offering pencil and ink drafting films made with Du Pont "Mylar".

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. . . *THROUGH CHEMISTRY*

DU PONT **MYLAR**® POLYESTER FILM

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Film Dept., Room M-8, Nemours Building, Wilmington 98, Delaware.

☐ Please send me samples of the new drafting film made with "Mylar" polyester film.

☐ Please send me information on properties, applications and types of "Mylar" available (MB-11).

Application_____

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Firm_____

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City_____ State_____

Uniformly molded gage cases are examined by Insulation Manufacturing officials. Left to right: Walter Dunham, Assistant Production Manager; G. W. Starke, Production Mgr.; R. W. Starke, Sales Manager.

Cuts preheating cycles with NEW 3RB at Insulation Manufacturing

Since 1943, Insulation Manufacturing Company, Brooklyn, N. Y., has installed 10 THERMEX* Plastic Preheaters. Two Model 3RB units have now joined the force and are giving these results, according to Walter Dunham, Assistant Production Manager:

"Preheating cycles have been cut considerably, especially on smaller loads, because the automatic load cycle control permits us to carry higher preform temperatures."

The THERMEX 3RB Preheater holds a uniform preform temperature, load after load, automatically compensating for changes in moisture content, preform density, room temperature. Cuts reject losses. Steps up production.

Write for Bulletin T95R4 on the 3RB or call the nearest sales office.

* THERMEX—Trade-Mark Reg. U. S. Pat. Off.

View in molding department showing latest Model 3RB Preheaters.

GIRDLER PROCESS EQUIPMENT DIVISION

CHEMETRON CORPORATION

Louisville 1, Kentucky

CHEMETRON

THERMEX SALES OFFICES: 76 Beaver St., New York 5, N.Y. • 133 So. Clinton Ave., Rochester 4, N.Y. • 505 Delaware Ave., Buffalo 2, N.Y. 239 Newton Avenue, Newark, Ohio • 624 So. Michigan Avenue, Chicago 23, Illinois • Russ Building, San Francisco, California

General Electric Progress Report on

VACUUM METALLIZING

"WE'RE SAVING 50% in tungsten costs with G-E 'Long-Grain' Tungsten", says Mr. Paul Gaeng, Plant Superintendent of Vacuum Metalizing Corp., L.I., New York—shown at left with Louis Gershey, process operator.

G-E "Long-Grain" Tungsten delivers twice as many "shots" per unit!

LONG ISLAND CITY, N.Y.—Vacuum Metalizing Corp., pioneers in vacuum coating with more than ten years of experience, report that, since switching to General Electric "Long-Grain" Tungsten Wire three years ago, their tungsten costs have dropped 50%.

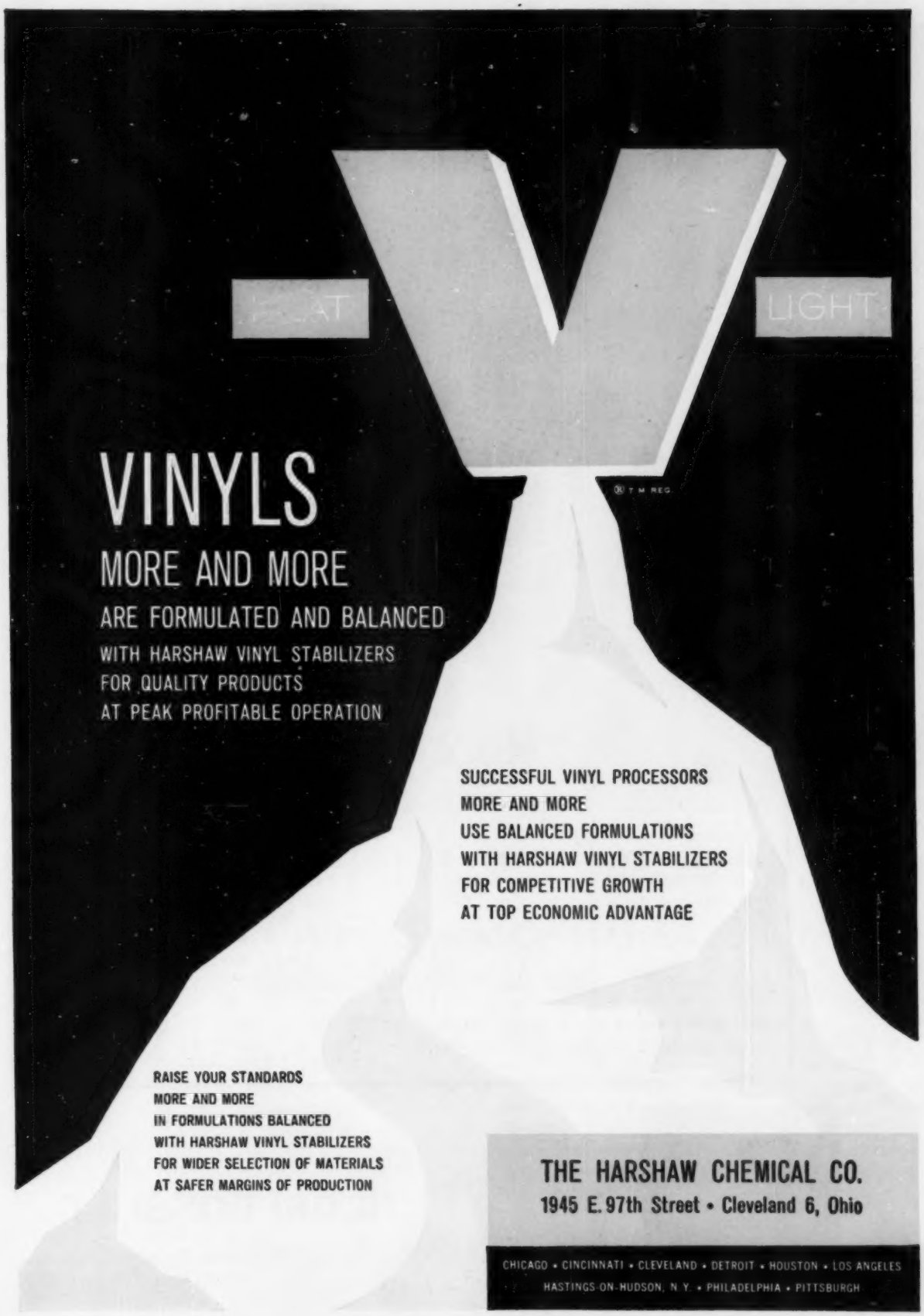
Here's why "Long-Grain" Tungsten delivers outstanding performance in plants of all sizes throughout the country. It is more ductile, it has excellent forming characteristics, and (as proved by Vacuum Metalizing Corp.) G-E "Long-Grain" Tungsten has longer useful coil life.

You can get General Electric "Long-Grain" Tungsten wire in single or multiple strands, or as ready-to-use coils, in the full range of wire diameters that are used in this field. If your particular process requires a custom-made coil, G-E engineers will be pleased to help you design one that will give optimum results.

Don't miss out on cost savings offered by G-E "Long-Grain" Tungsten. Get the whole dramatic story by writing: General Electric Co., Lamp Wire and Phosphors Dept. MP-88, 21800 Tungsten Road, Cleveland 17, Ohio.

Progress Is Our Most Important Product

GENERAL ELECTRIC


VINYLS
MORE AND MORE
ARE FORMULATED AND BALANCED
WITH HARSHAW VINYL STABILIZERS
FOR QUALITY PRODUCTS
AT PEAK PROFITABLE OPERATION
SUCCESSFUL VINYL PROCESSORS
MORE AND MORE
USE BALANCED FORMULATIONS
WITH HARSHAW VINYL STABILIZERS
FOR COMPETITIVE GROWTH
AT TOP ECONOMIC ADVANTAGE
RAISE YOUR STANDARDS
MORE AND MORE
IN FORMULATIONS BALANCED
WITH HARSHAW VINYL STABILIZERS
FOR WIDER SELECTION OF MATERIALS
AT SAFER MARGINS OF PRODUCTION
THE HARSHAW CHEMICAL CO.
1945 E. 97th Street • Cleveland 6, Ohio
CHICAGO • CINCINNATI • CLEVELAND • DETROIT • HOUSTON • LOS ANGELES
HASTINGS-ON-HUDSON, N.Y. • PHILADELPHIA • PITTSBURGH

EACH NB & C. INJECTION PRESS ENJOYS TWO YEARS GUARANTEE

NB&C

INJECTION PRESSES
ENSURE FIRST-CLASS
GREAT PRODUCTIVITY
CUTTING DOWN COSTS

powerful newly-conceived, built-in oildynamic circuits

increased plasticizing capacity

higher injection rapidity

SPECIFICATIONS

model	NB 28	NB 30 Record	NB 40	NB 60 E	NB 100	NB 120 E	NB 160
injection capacity oz.	1	1¼	1.4	2.1	3.5	4.2	5.6
hourly plasticizing capacity lbs.	6.6	12	15.4	28.6	26.4	53	39.6

			FULLY AUTOMATIC				
model	NB 220 E	NB 360/520 E	R 01	R 02	R 6 FA	R 12 FA	R 20 FA
injection capacity oz.	8	13-19	0.53	0.85	2-3	4-6	8-12
hourly plasticizing capacity lbs.	75	97	7.7	7.7	29	53	75

ASK FOR LITERATURE!

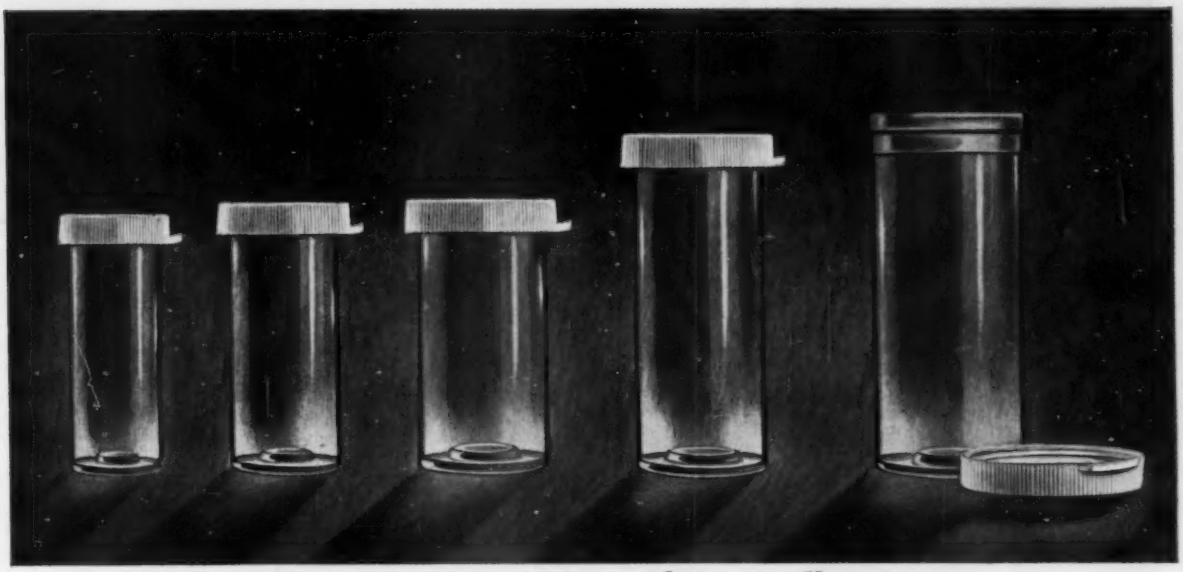
NB&C

NEGRI BOSSI & C.

MILANO/ITALY - VIA BAZZINI 24 - TELEF. 235.555 - 230.512 - 235.884
CABLES NEGRIBOS MILANO

Easy off . . .
Snap-Caps pop off crisply!

Easy on . . .
Snap on tightly no matter how often used!



Eye-catching in all 7 sizes . . .
Trim, attractive—new Snap-Cap Plastic Vials are available in 7 sizes, with these approximate capacities: 1, 3, 5, 7, 9, 13, and 15 drams.

Here's the salespackage you asked for—
a crystal-clear Plastic Vial with a SNAP-CAP!

Here's good packaging news! Owens-Illinois Plastic Vials are now available with SNAP-CAPS. It's a combination that fills a wide variety of packaging needs.

The vial, itself, has many advantages: its clarity provides perfect vision of your product . . . straight sides ease labeling . . . opening is reinforced for extra strength, added resistance to cracking or splitting . . . and its large-diameter opening speeds filling . . . eases removal, too.

The Snap-Cap offers unmatched user convenience: Pops open *crisply* . . . always snaps closed *tightly*—no matter how often it is used . . . provides lasting protection for your product at welcome low cost.

Find out more about Plastic Vials with Snap-Caps. Your O-I representative has samples and complete information. Call him today!

OWENS-ILLINOIS PLASTICS
AN (O) PRODUCT

OWENS-ILLINOIS
GENERAL OFFICES · TOLEDO 1, OHIO

PRODUCT-DESIGN MEMOS FROM DUREZ

Insulative molding compounds | **Corrosion-resistant polyester** | **Low-cost control knobs**

Official U. S. Navy photo

But what if it rains?

From time immemorial, weather has upset the military plans of men. In colonial days, wet gunpowder could lose a skirmish. Today, one moisture-affected part can nullify months of costly labor on a new missile.

This helps to explain the increasing pressure on moisture-resistant insulations for electronic parts that must not fail. It explains, too, the growing interest in a relatively new Durez molding material, *diallyl phthalate*.

This is the *only* plastic that retains its high insulation values over extended periods at relative humidities above 90%.

Its arc resistance, as measured by ASTM D495 (Method A or B), can be consistently reproduced.

It does not corrode metal contact points.

Because it is a thermosetting material, it provides virtual freedom from cold flow and creep.

You can get this material from us as an orlon-filled granular blue or green molding compound with plasticity values of 10, 12, or 16 by ASTM D731. It is designed to meet the requirements of Mil-M-18794, Type SDI-5.

For a data sheet detailing properties of the compound, and of molded material, check the coupon.

Hetron® ducts outlast metal

Perhaps you've been thinking of Hetron mainly as a *fire-retardant* polyester material.

It's true you get outstanding fire retardance with Hetron. But don't overlook its *corrosion resistance*, which is equally impressive in equipment such as this glass-reinforced ductwork manufactured by duVerre, Inc.

Venting corrosive fumes from a chemical reactor, aluminum ducts failed in 11 months. Ducts made of Hetron 92 replaced them—and have gone 17 months without a sign of deterioration.

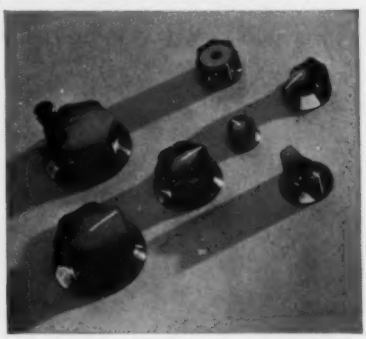
In another plant, Hetron 92 replaces rubber-lined steel ductwork which lasted

duVerre, Inc.

less than a year under the corrosive bite of wet chlorine. The Hetron ductwork, in service four years, has required no maintenance and is as sound as the day it was installed.

Because it is self-extinguishing, you can safely specify Hetron in many places where a conventional polyester won't do. Fire retardance is *inherent*—does not depend on additives that might dilute corrosion resistance.

Are you taking full advantage of Hetron's unique qualities? A check mark on the coupon will bring you an illustrated bulletin outlining properties and uses of the versatile Hetron resin family.



Ready-tooled knobs

Why tool up for a standard item like a control knob, when you can buy general-purpose knobs like these—probably at a good saving?

Many custom molders can supply knobs in Durez phenolic, from stock tooling, to fit most standard mountings. You can have them hot-stamped with numbers or characters; equipped with special motifs.

Styled as a family, they blend smoothly with modern equipment lines; wipe clean without dulling; and stand up to heat, dampness, and corrosive atmospheres. For further information, consult your molder.

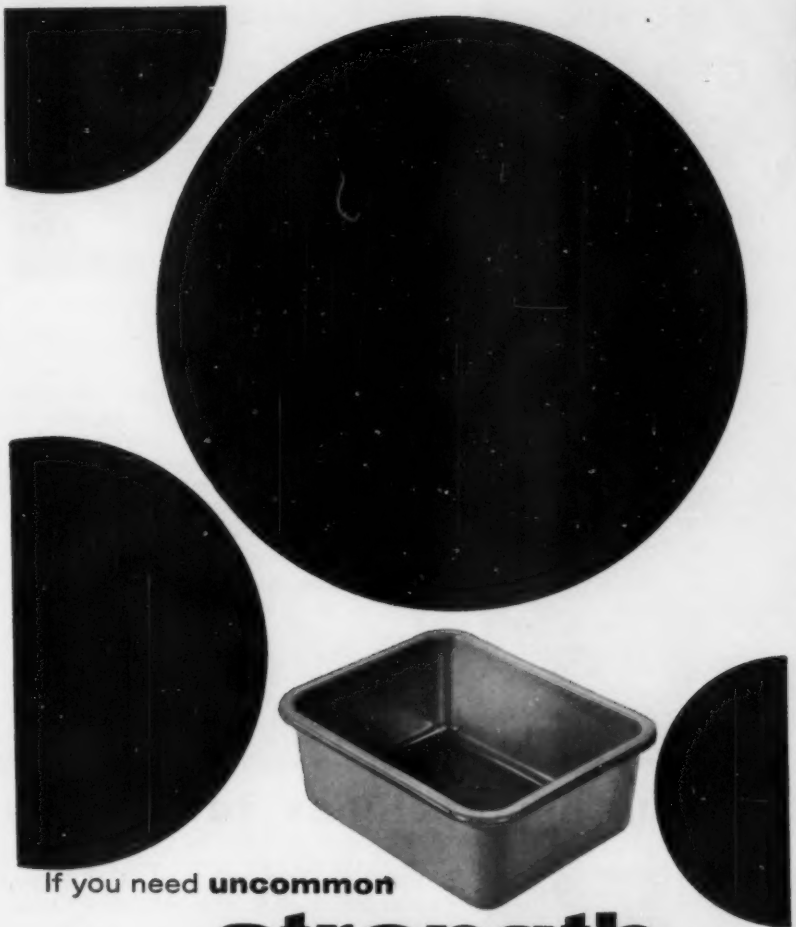
For more information on Durez materials mentioned above, check here:

- ☐ Diallyl phthalate, Durez 16694
- ☐ Hetron polyester resins (bulletin)

Clip and mail to us with your name, title, company address. *(When requesting samples, please use business letterhead.)*

DUREZ® HOOKER CHEMICALS PLASTICS

PLASTICS DIVISION
HOOKER CHEMICAL CORPORATION
12008 Walck Road, North Tonawanda, N. Y.



If you need **uncommon**

strength...

make it with **GREX***

HIGH DENSITY POLYETHYLENE

Strength and sales appeal are twin imperatives in today's highly competitive housewares market . . . and GREX high density polyethylene gives a brand new measure of both!

This colorful dish pan, for example, is tough and rigid, can hold boiling water, will not warp, resists detergents and bleaches, and keeps its high gloss and attractiveness.

This same plastic makes crisper-trays, food containers and tumblers that never turn brittle, never shatter when frozen, and are easily cleaned.

These very qualities of durability recommend GREX for a limitless variety of uses: refrigerator parts that stand up under heavy loads and cold temperatures; sterilizable bottles; canisters and cups that don't break; automotive parts . . . toys . . . furniture drawers. You name it, and we'll show how *this versatile plastic means better products for you.*

*Trade mark for W. R. Grace & Co.'s polyolefins. W. R. Grace & Co. produces GREX resin in a wide variety of sizes, does not make the finished articles mentioned above.

W. R. GRACE & CO.

POLYMER CHEMICALS Division

GREX* in action

That dishpan on the left was molded from GREX high density polyethylene by an important new process . . . a Pre-Compressed Molding process which gives highly superior products, substantial dollar savings, and greater economy of operation.

Pre-Compressed Molding

In this new molding process, the gates contain valves that are closed as the injection takes place, and the material in the heating chamber, runners and sprues is compressed to the maximum pressure for molding. At optimum pressure, the valves are automatically opened and the plastic material pours into the cavity at high velocity. The valves are then closed and the finished part is ejected without sprues or gates—another plus feature. Multiple or single cavity molds may be valve-gated as well as individual runners in molds with an unusually large number of cavities.

It makes possible bigger, deeper molds and produces strain-free moldings with greatly improved physical properties, particularly in impact strength. Parts are freer from stresses, poor welds, trapped air and cracks . . . surface finish on parts noticeably improved.

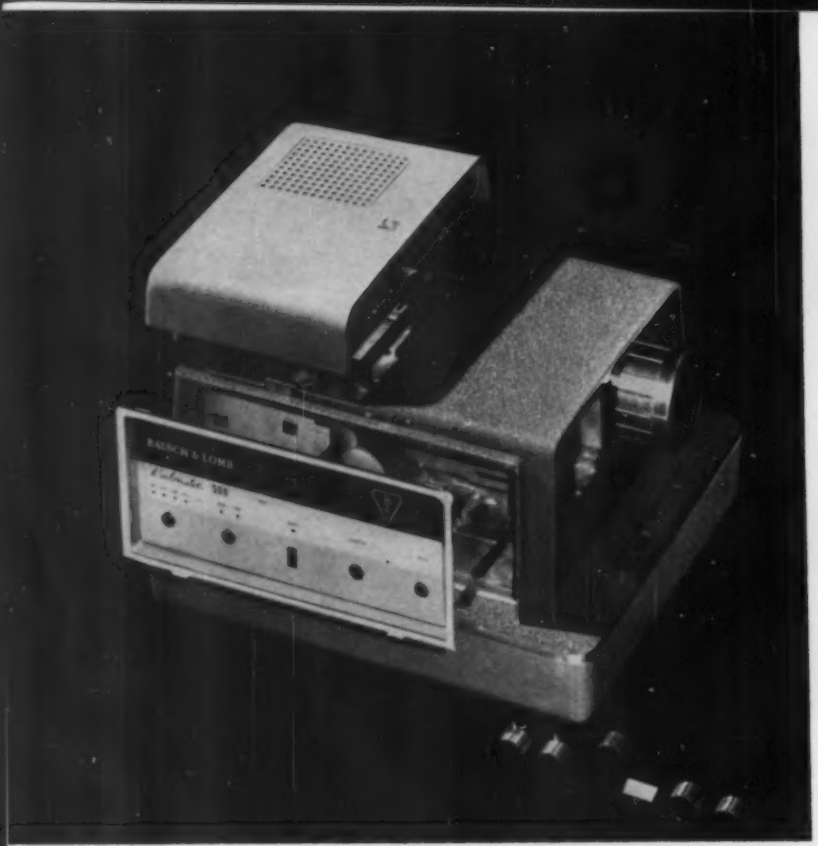
Scrap losses are decreased. Because no gates or sprues need be trimmed, finishing cost are reduced. With lower machine temperature, warpage, material breakdown, shrinkage marks and color variations are virtually eliminated for all thermoplastic materials.

Since GREX high density polyethylene is suitable for elevated temperature applications and can be boiled and sterilized, it is particularly important that moldings be strain free and warpage be minimized. This new process almost invariably reduces molding cycle time for GREX and other thermoplastics—usually one-half to two thirds!

Putting this Process to Work for You

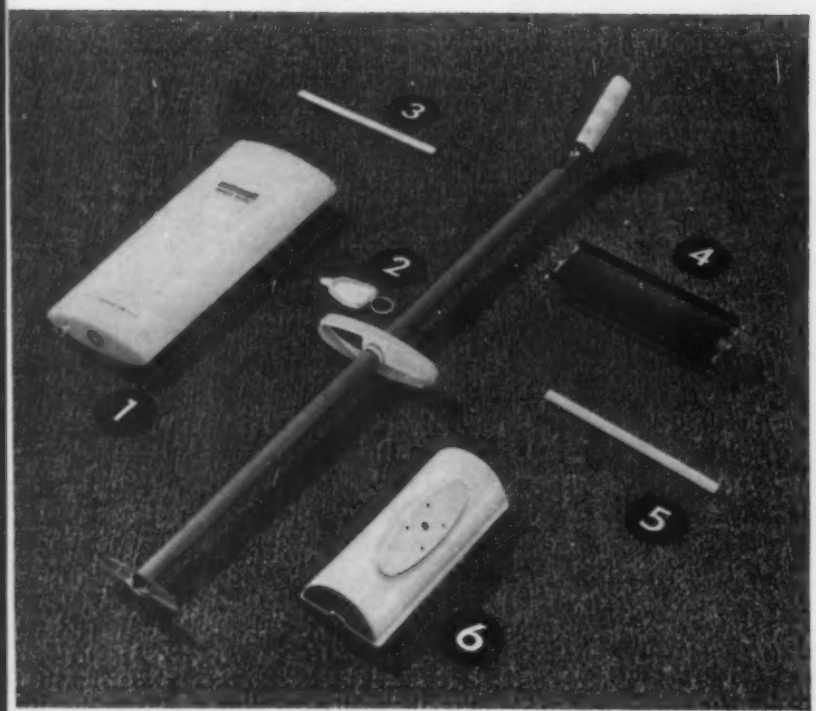
GRACE's Polymer Chemicals Division has been licensed exclusively under patents held by Columbus Plastic Products, Inc., Columbus, Ohio, and in turn GRACE will sub-license plastic molders so that the benefits of this new process may be made widely available.

For more information write for your copy of "The Story of Pre-Compressed Molding."



VERSATILE STYRON 440M was used for the top cover and slide holder of this handsome slide projector. Its outstanding moldability permits thick side walls and extremely thin separator sections for the slide holder. Other characteristics of 440M include heat resistance, high impact strength and a wide range of colors. The crystal clarity of Styron 666 allows second surface finishing on the escutcheon, and its easy flow reduces weld lines to a minimum.

Dow plastics bring your design ideas to life!



FOUR DIFFERENT Dow plastics were used in this modern, functional rug shampooing appliance. Styron® 480 was selected for dimensional stability and extra high impact strength. Attractive finish, chemical resistance and imperviousness to water made Styron 475 a good choice. Ethocel® was used because of its super impact strength and glossy finish. Saran was selected for the bristles because of its ability to maintain stiffness, its resistance to chemicals and water absorption.

1. TANK Styron 475 2. TANK COVER Styron 480
3. DISTRIBUTOR STRIP Styron 480 4. BRISTLES Saran
5. APPLICATOR AXLE Styron 475 6. APPLICATOR HOUSING Ethocel

The list of designs like these—with Dow plastics improving both appearance and performance—is growing longer every day. If you're designing or producing products, keep abreast of the fast-moving developments in Dow plastics. Contact the Dow man near you or write to THE DOW CHEMICAL COMPANY, *Midland, Michigan, Plastics Sales Department 1515B.*

YOU CAN DEPEND ON DOW

A NEW DIAMOND DEVELOPMENT...

ANNOUNCING CARBIUM

a new precipitated calcium carbonate for faster, easier, low-cost processing

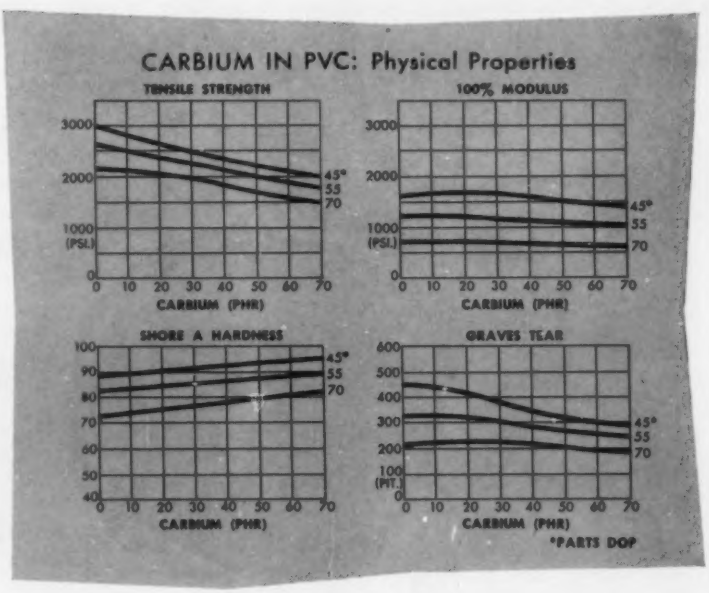
CARBIUM is a new dense precipitated calcium carbonate developed by Diamond for use as a superior filler in PVC resins.

CARBIUM provides easier, more economical, more uniform processing. Gives good color stability in all PVC applications. Demonstrates both low initial viscosity and low viscosity build-up in plastisols and organosols.

Physical Properties of CARBIUM

Linseed Oil Absorption, cc/100 grams	30-35
Packed Density, lbs./cu. ft.	66-73
Specific Gravity	2.65
Color	White
Particle Size, microns	1-10

Write today for Technical Bulletin, *CARBIUM: A New Filler for PVC Resins.* Ask Diamond's technical service group for any assistance you need in the application of Diamond Chemicals. DIAMOND ALKALI COMPANY, 300 Union Commerce Bldg., Cleveland 14, Ohio.



Diamond Chemicals

Around the World in 80 Years

. . . plastics parts molded by Consolidated, that is. In every part of the globe — from Scranton, Pennsylvania to Sidney, Australia — people are using and enjoying products made more dependable by components from Consolidated. Now, with two plants working for you in Scranton, Pennsylvania, and one in Binghamton, New York, we are better prepared than at any other time in our 80 year history to take care of your requirements.

"Your Blueprint in Plastics Since 1874"

Consolidated Molded Products Corporation

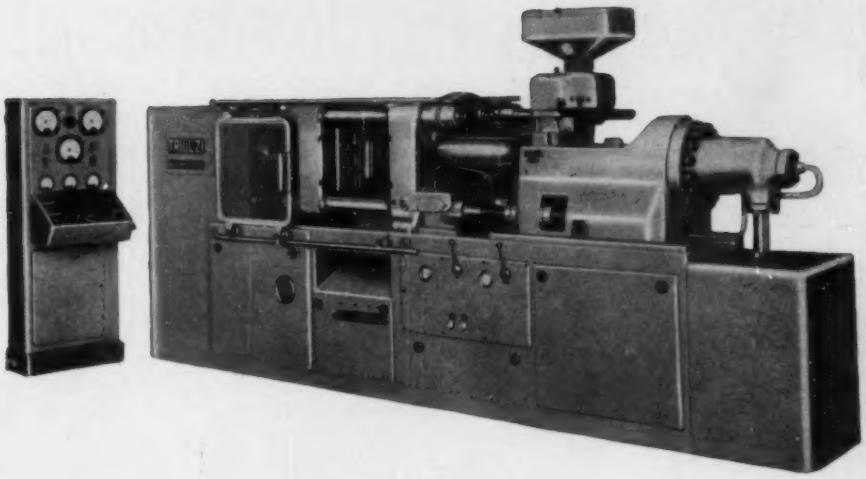
Scranton, Pa. Binghamton, N. Y.

IF YOU are interested in learning more about injection and compression molding by Consolidated, send for our new, fully illustrated company brochure. Write to: Consolidated, 330 Cherry Street, Scranton 2, Pennsylvania.

TRIULZI *Plastmatic*

Injection Molding Machines

Models 200, 300, 600 available.
Capacities, 7 to 21 oz.



- **Fully Automatic**
- **Fast-Cycling**—thanks to special electronic controls and heating cylinders which make possible an exceptional number of molding cycles.
- **Easy to operate**—thanks to hydraulic adjustment.
- **Self-Contained**
- **Ruggedly Built**
- **Horizontal and Vertical**
- **Special Safety Devices**—including a device to safeguard the molds.
- **Wide Range of Machines**—with injection capacities from ¼ oz. to 350 oz. (Model PL 6/10, with 350 oz. capacity, is Europe's largest.)

TRIULZI'S FULL LINE OF FINE MACHINES INCLUDE–

Compression and Transfer Molding Presses
(hydraulic, self-contained, with automatic dosing devices)

Presses for Reinforced Plastics

Presses for Rubber and Plastics Laminates

Hobbing Presses

Write for free literature TODAY!

A. TRIULZI S.A.S.

VIA G. DA PROCIDA 8/MILAN (640), ITALY/Cable Address: TRIULZIPRES–MILANO

Plastics problem got you down?

Get help in a hurry from your Encyclopedia Issue!

EXAMPLE: ***Where and how to use resins and molding compounds?***

1. See the section "Resins and Molding Compounds" for all the fundamentals. Also see the materials charts and supplier lists in the "Technical Data" section.
2. Then check the Advertisers' Index—on the first page of the "Resins . . ." section—for suppliers' ads on resins, coatings, emulsions, etc.
3. Secure additional names and addresses of suppliers from extensive Buyers' Directory lists in the back of the book.
4. Consult the Alphabetic Index for detailed cross-referenced listings of subjects related to your particular inquiry.
5. For more data, mail us the post cards in the enclosed Encyclopedia "How-to-use-it" Guide.

EXAMPLE: ***How to color plastics?***

1. See the section "Chemicals for Plastics" for complete background.
2. Next, refer to the Advertisers' Index on the first page of the section for ads relating to your specific needs.
3. Check the Buyers' Directory for a detailed listing of suppliers of dyes, stabilizers, plasticizers, etc.
4. Consult the Alphabetic Index for detailed cross-referenced listings of subjects related to your particular inquiry.
5. For further information, send us the post cards in the enclosed "How-to-use-it" Guide.

EXAMPLE: ***How to design a product—then get it made?***

1. Get the basic facts in the section "Engineering and Methods".
2. Then for molder and special service advertisements, see the Advertisers' Index on the section's first page.
3. Next, examine the Buyers' Directory for additional names and addresses of molders, extruders and service organizations.
4. Consult the Alphabetic Index for detailed cross-referenced listings of subjects related to your particular inquiry.
5. Send us the post cards in the enclosed "How-to-use-it" Guide for further information.

EXAMPLE: ***Which machinery to buy?***

1. Turn to the section "Machinery and Equipment" for a complete picture of the factors involved.
2. Then see the Advertisers' Index on the first page of this section and select ads whose messages bear on your problem.
3. Get further information—names and addresses of machinery, machine tool and equipment manufacturers—in the time-saving Buyers' Directory.
4. Consult the Alphabetic Index for detailed cross-referenced listings of subjects related to your particular inquiry.
5. Write for more information using the conveniently enclosed post cards in the "How-to-use-it" Guide.

The Encyclopedia is expressly designed to help you solve your problems. Reach for it next time you need help and see how valuable it can really be!

MODERN PLASTICS ENCYCLOPEDIA ISSUE

. . . for fast, accurate answers to plastics problems

Why best-selling plastic products of tomorrow begin with Glidden pigments today

In an increasingly competitive market, the top-quality products you produce—and *sell*—must appeal with every color advantage possible.

Colors must be bright and clean. Opacity and hiding power are basic. Uniformity of tone value must be consistent. And colors must be locked in for maximum resistance to fading and bleeding.

Glidden pigments fulfill all of these requirements. Glidden *Zopaque* Titanium Dioxide is the whitest white pigment available. New *Mercadmolith* (mercury-cadmium) and *Cadmolith* (cadmium-selenium) colors offer a combination of advantages found in no other reds and yellows. They are soft, easy to grind; insoluble in all vehicles; high in heat resistance.

Be sure to specify Glidden—a leading supplier of finest pigments to industry.

By the makers of Sunolith Lithopones . . . Euston White Lead . . . Resistox Copper Pigments

THE GLIDDEN COMPANY

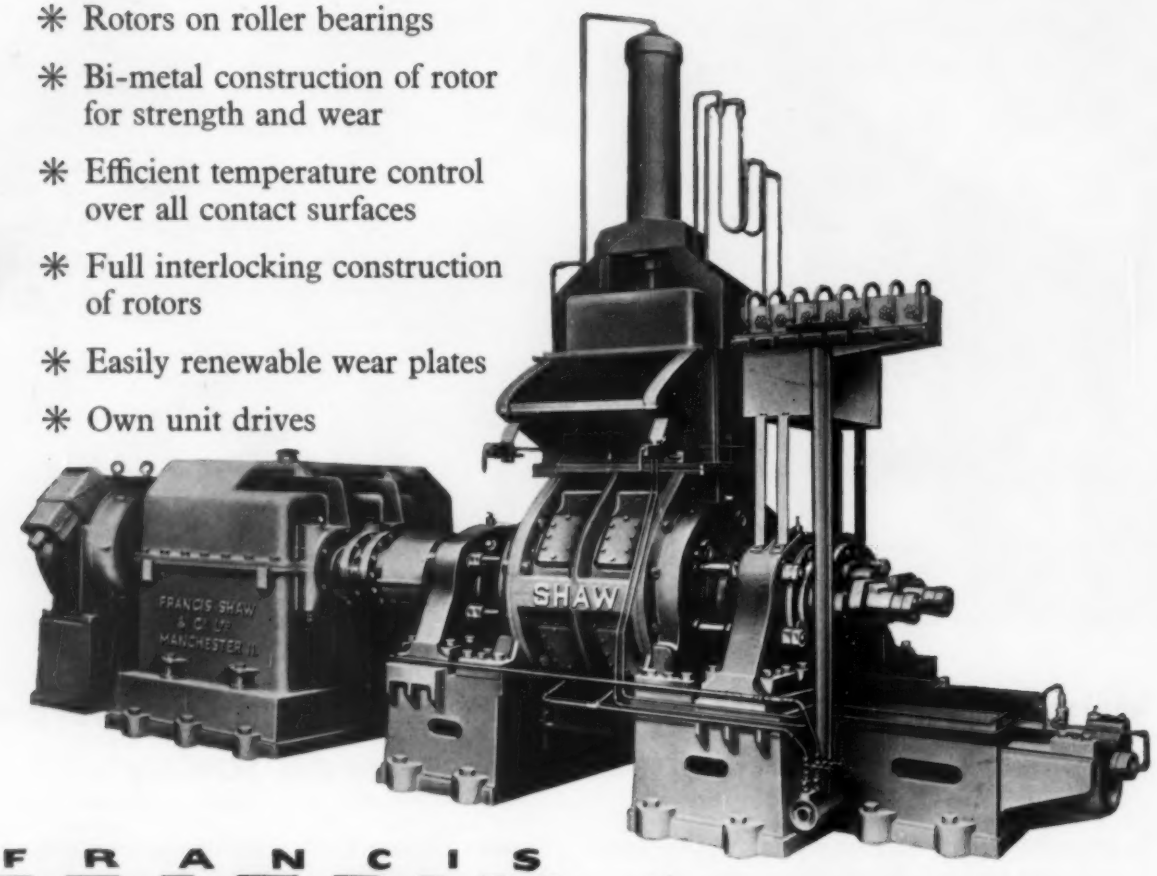
Chemicals • Pigments • Metals Division

Baltimore, Maryland • Collinsville, Illinois • Hammond, Indiana • Scranton, Pa.

QUALITY Glidden PRODUCTS

NO OTHER INTERNAL MIXER CONTAINS ALL THESE ADVANTAGES

* Rotors on roller bearings
* Bi-metal construction of rotor for strength and wear
* Efficient temperature control over all contact surfaces
* Full interlocking construction of rotors
* Easily renewable wear plates
* Own unit drives



FRANCIS SHAW

the **intermix** *internal mixer*

quality engineering for quantity production

FRANCIS SHAW & COMPANY LIMITED MANCHESTER 11 ENGLAND

TELEPHONE EAST 1415-8 TELEGRAMS CALENDER MANCHESTER TELEX 66-357

LONDON OFFICE 22 GREAT SMITH STREET SW1 PHONE ABBEY 3245 GRAMS VIBRATE LONDON TELEX 2-2250

Enquiries to FRANCIS SHAW (CANADA) LIMITED GRAHAMS LANE BURLINGTON ONTARIO CANADA

Now for the first time! A liquid stabilizer that gives your vinyl plastics lasting crystal clarity

New "Dutch Boy" Invin* 91

Lasting crystal clarity! Exceptional heat, light and color stability!

That's what the new "Dutch Boy" liquid, barium-cadmium-stabilizer, Invin 91, contributes to vinyl "clears". When you try it, you'll notice excellent freedom from the initial heat yellowing that interferes with water-whiteness. Later processing and service heat changes initial clarity only slightly . . . if at all.

When it comes to colored stocks—well, you've never seen a stabilizer maintain clearer and truer shades. That holds for both tinted "clears" and pigmented opaques.

Even long exposure to the severe heat—such as encountered by the rear window of a convertible – has little effect when the vinyl is protected by Invin 91 stabilizer.

Wonderful to work with!

In formulating with "Dutch Boy" Invin 91 stabilizer, users will find no critical problems with plasticizers, colorants, or fillers. You are free to use it in a wide variety of formulations.

Milling, calendering, and extruding will prove just as satisfactory. No problems from heat breakdown, plate-out, rework of trim.

See all this for yourself. Write for literature, for samples, for technical application aid.

Dutch Boy® CHEMICALS

*Trademark

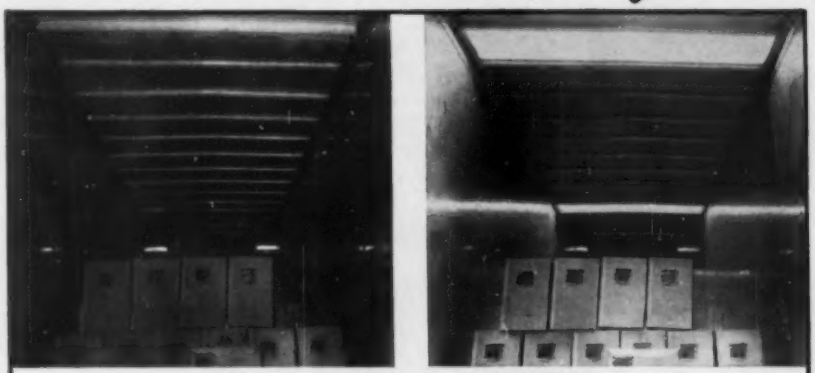
NATIONAL LEAD COMPANY, 111 Broadway, New York 6, N. Y.

In Canada: CANADIAN TITANIUM PIGMENTS LIMITED, 630 Dorchester Street, West • Montreal

Garan® ROVING & RESIN COMBINE TO PRODUCE

Practical New Truck Skylight

Panel Made From Garan Woven Roving Increases Truck Utility by Permitting up to 60% Light Transmission With No Sacrifice of Mechanical Strength in Roof



HERE'S POSITIVE PROOF*

Photograph at left was taken with skylights covered. Front roof caps were left uncovered and one rear door open 12". Light meter reading of 0.2 candle power.

Photograph at right was taken of same trailer with one rear door sealed and second open one foot. No artificial light used. Light meter reading was 3.2 candle power.

*Unretouched photographs taken by Fruehauf Trailer Company, Detroit, Michigan.

Fiber Glass Industries, Inc., Amsterdam, N. Y. produces Polyply Skylights in widths of 19 and 25 inches, in lengths of 90 to 94 inches with three layers of resin bonded ROVCLOTH molded to the panel's metal frame.

Another efficiency problem in multi-stop trucking operations has been solved—thanks to the unique characteristics of Garan Roving, pioneered by L·O·F Glass Fibers Company.

Diffused light into truck trailer working areas now permits sorting, checking and delivery organization without moving items to the door for label reading.

Garan Woven Roving produces laminates having uniformly high physical properties.

Garan Roving was selected because it produced thin, strong panels having more strength than steel on an equal weight basis; unusually high flexural strength; better weatherability.

WITH GARAN WOVEN ROVING YOU GET:

faster wet-out . . . better bond . . speedy production.

improved flexural, compressive and tensile strengths.

high wet-strength retention . . . added durability.

Because Garan Roving is made by the marble process, it permits clearer, color-free laminates . . . a feature of great importance in applications where translucency is required.

For technical information about Garan Roving and how it can help improve your product . . . open new markets, call our nearest sales office, or write: L·O·F Glass Fibers Company, Dept. 15-88, 1810 Madison Avenue, Toledo 1, Ohio

L·O·F GLASS FIBERS COMPANY
TOLEDO 1, OHIO

FRANKLIN PLASTICS, INC.

relies exclusively on

NRM *Thermoplastics* EXTRUDERS

...to maintain quality and precision in DUR-X® PLASTIC PIPE

NRM 2½" Electrically Heated Extruder with offset pipe die.

Using NRM Extruders from compact 2½" machines like the one shown, to big 6" high production models, Franklin Plastics, Inc. of Franklin, Pa. annually produces millions of pounds of DUR-X Pipe in all sizes for distribution throughout America, and abroad. In discussing the unusually rapid growth of their plastics extrusion department since it was started in 1951, Franklin officials had this to say . . .

"NRM Extruders have contributed importantly to the trade success of DUR-X Plastic Pipe . . . with their exceptional abilities for holding tolerances precisely, while producing fine quality extrusions at high pounds per hour rates. These, plus their low operating cost and minimum maintenance requirements, are a few reasons why we use NRM Extruders exclusively."

NRM's reputation for high output of fine quality, close tolerance extrusions at low cost for operation and maintenance, are reasons why *most* leading plastics extruders like Franklin Plastics, Inc. "go NRM" when they buy extruders and equipment. On request we'll send engineering data and performance facts on the NRM full line . . . Compare NRM advantages with any other plastics extruder and you, too, will *standardize* on NRM. Write today.

2952

NATIONAL RUBBER MACHINERY COMPANY

NRM

General Offices and Engineering Laboratories: 47 West Exchange St., Akron 8, Ohio
EASTERN PLANT: 384 Getty Ave., Clifton, N. J.
SOUTH: The Robertson Company, Rutland Building, Decatur, Ga.
WEST: S. M. Kipp, Box 441, Pasadena 18, Cal.
MID-WEST: National Rubber Machinery Company, 5875 N. Lincoln Ave., Chicago 45, Ill.
CANADIAN: F. F. Barber Machinery, Ltd., 187 Fleet St., West, Toronto, Ont.
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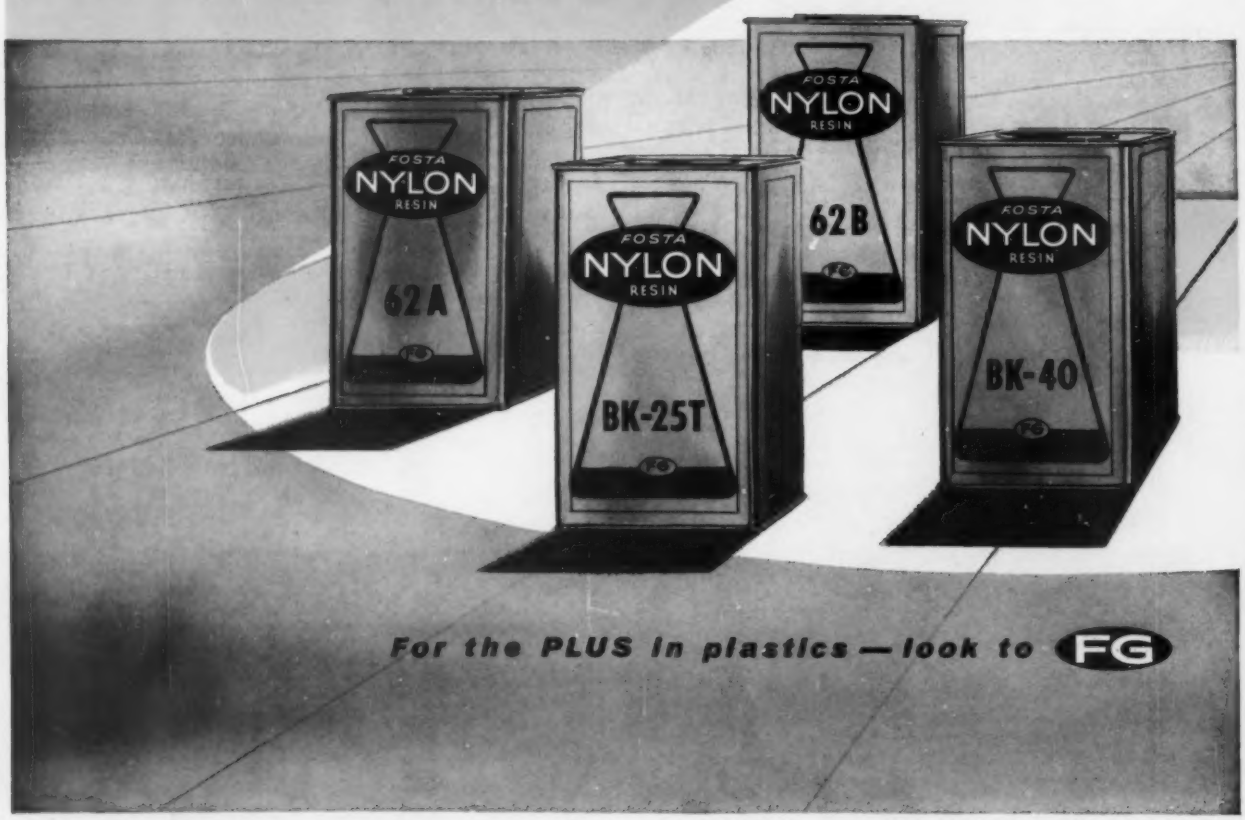
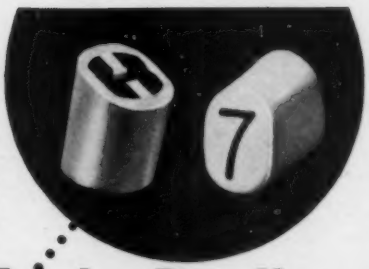
The growing preference for nylon products in both consumer and industrial applications has created important, new markets for the plastics industry. To help the molder and extruder meet this increasing demand, Foster Grant offers a complete range of nylon materials — five grades, custom compounded for the specific requirements of the end product, and for maximum efficiency in production.

As always, the industry may look to Foster Grant for *production proved*, quality materials and for production assistance based on 40 years' experience as a pioneer in the plastics industry.

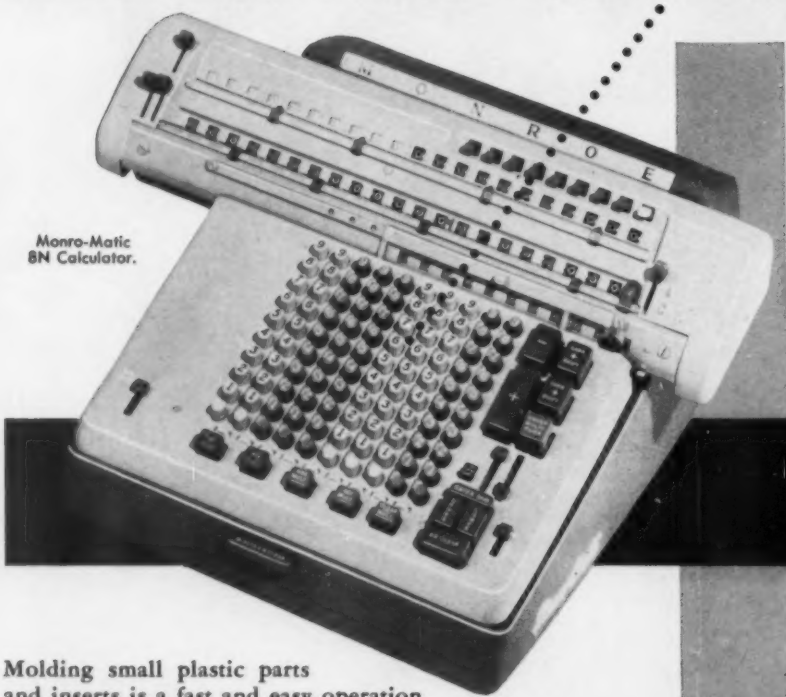
To learn more about Fosta Nylon and its potential for you, write for our new, informative brochure, "Fosta Nylon — Its Role in Your Operations."



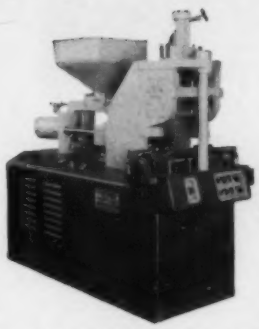
For the PLUS in plastics — look to **FG**



Monroe Molds Inserts Better and Faster with Moslo Duplimatics



Monro-Matic 8N Calculator.



Cord Plug and Insert Molding is easily done on the Moslo 3-ounce Duplimatic.

The 2-station shifting table on the Duplimatic permits loading one side while parts are being automatically molded on the other side.

Molding small plastic parts and inserts is a fast and easy operation with Moslo plastic injection molding machines.

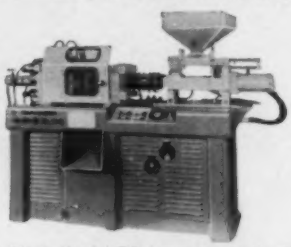
One leading manufacturer, Monroe Calculating Machine Company, Inc., has put the Moslo Duplimatic to good use in producing multi-colored keys for their calculating machines. The pre-molded plastic letters and numerals are placed on the Moslo Duplimatic. In one completely automatic operation, the second color is molded around the insert.

The letters, symbols and numbers become an integral part of each key—giving years of service and permanent readability.

This is just one example of how Moslo machines are cutting production costs and producing a better product through plastic injection molding.

Moslo machines are ideally suited for an infinite number of applications. If your manufacturing requires small parts or insert work, we will be glad to demonstrate how Moslo equipment can help you do a better job.

Our sales and engineering staff is available without obligation. We cordially invite your inquiry. Financing plan available.



The Moslo Model 75-4 ounce and the 74-2 ounce are completely automatic plastic injection molding machines. Used in conjunction with the Duplimatic they make an ideal combination for insert molding.

Illustrated are keys for a Monroe Calculator. The insert work on these was done on the Moslo Duplimatic.

MOSLO
MACHINERY COMPANY
2442 Prospect Ave. • Cleveland 15, Ohio

BAKELITE COMPANY • DIVISION OF UNION CARBIDE CORPORATION

RIVER ROAD, BOUND BROOK, N. J.

July 30, 1957

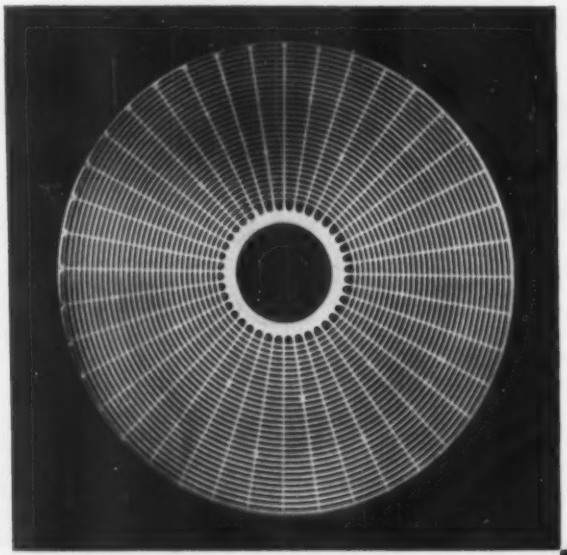
Claremont Pigment Dispersion Corp.
39 Powerhouse Road
Roslyn Heights, L.I., N.Y.

Attention: Mr. H. C. Felsher,
Chief Chemist

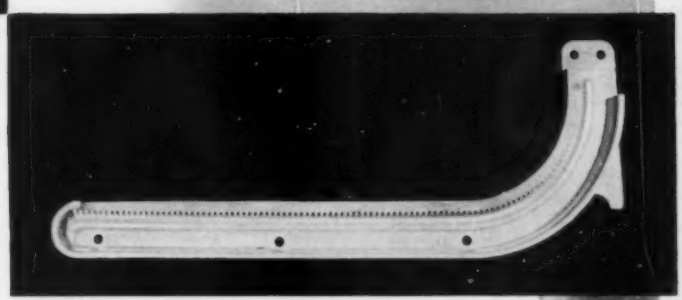
Dear Sirs:

The Surfacing and Printing Group of the Bakelite Company is very much interested in learning what inks Claremont would recommend for the flexographic and gravure printing of two of its recently developed products.

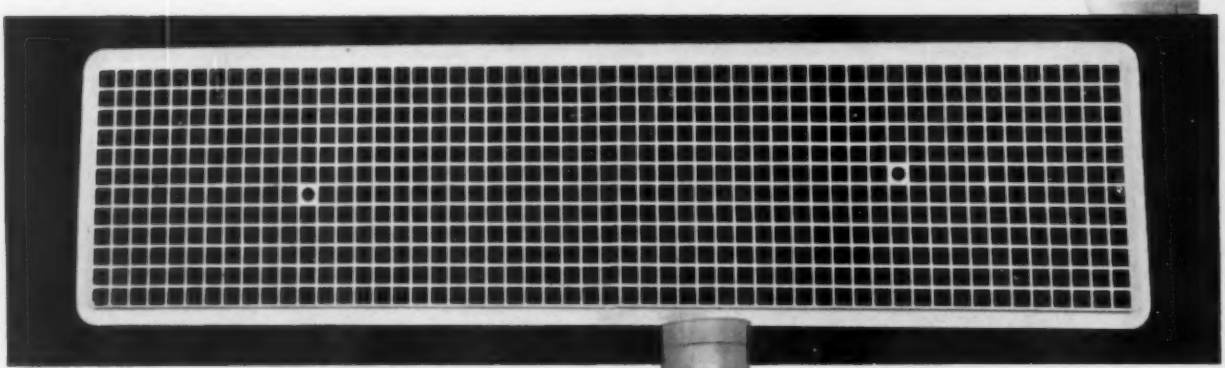
LARGE and

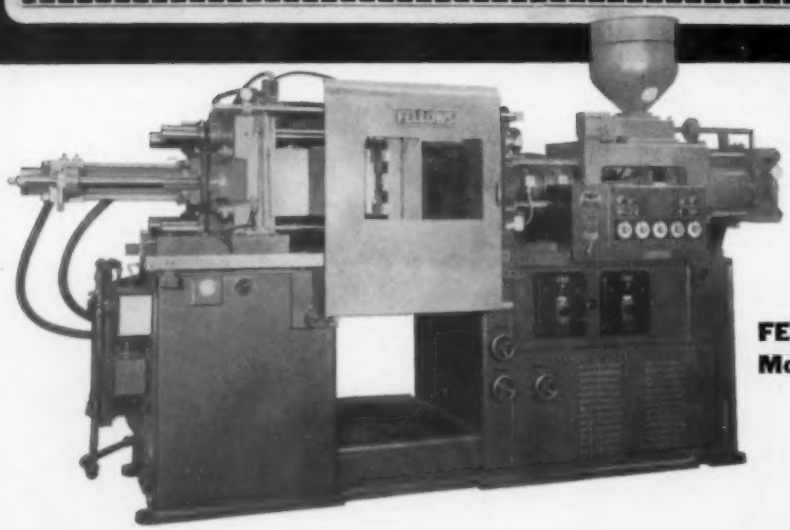


VENTILATING SYSTEM PART
11⅜" diameter
5.15 oz. Hi-impact Styrene
Production time: 30 seconds



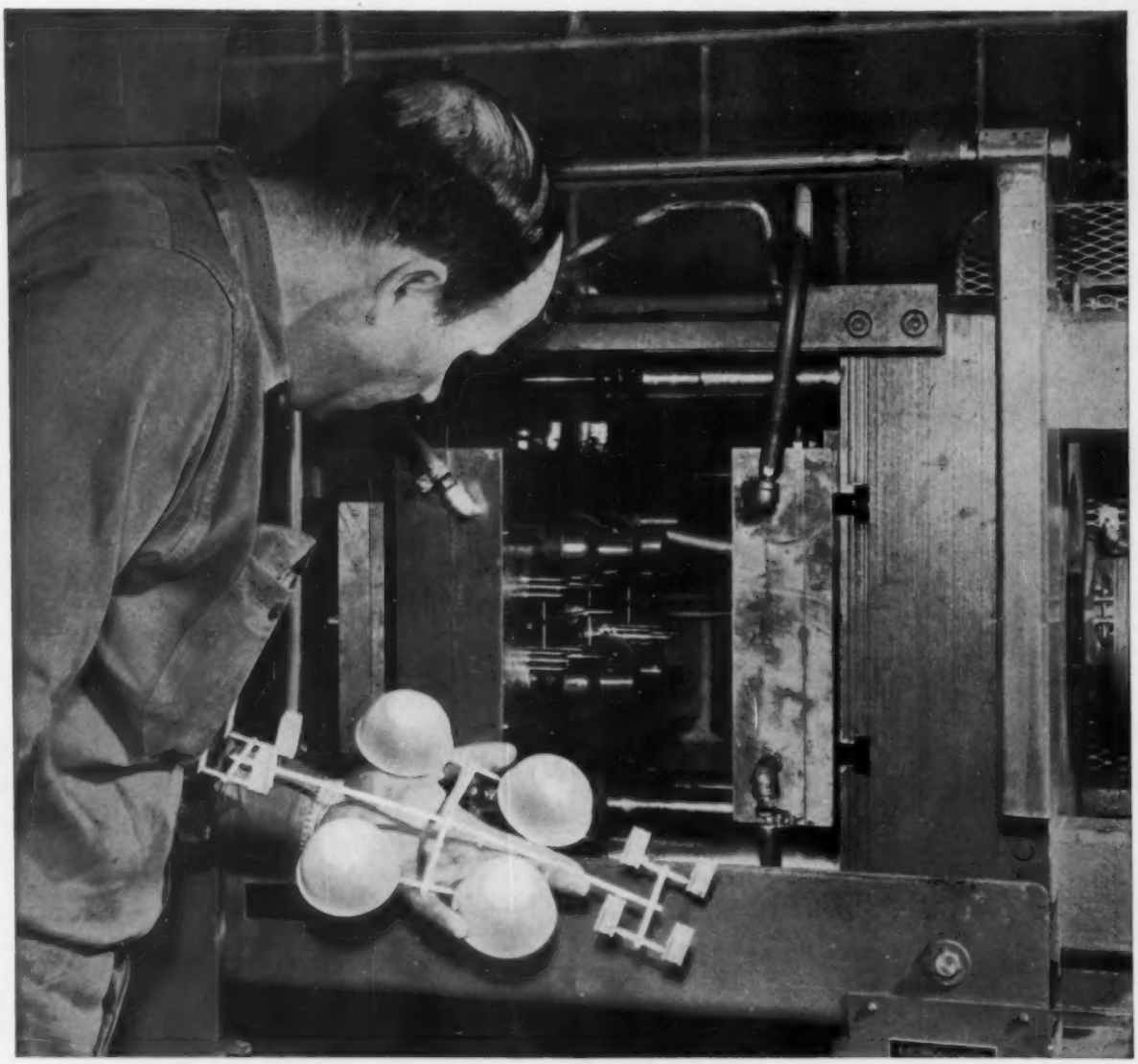
LUGGAGE COMPARTMENT PART
12 15/16" long
4.72 oz. Nylon
Production time: 90 seconds





VENTILATING SYSTEM PART
25¼" x 6 5/16"
8.77 oz. Hi-impact Styrene
Production time: 28-30 seconds
(Including two pre-packs)

FELLOWS
Model 6-200



For Long Runs and High Polish They Molded Bowls with Lustre-Die

Long runs and high polish were the main requirements when Chris Kaye Plastics Manufacturing Co., Madison, Ill., began tooling up to produce plastic bowls for a popular blender. The problem was put up to our local tool steel distributor, Ford Steel Co., St. Louis, who recommended Lustre-Die. The die was produced by Lambert Engineering Co., St. Louis.

The result? An economical die in every way, plus a finished product having plenty of eye appeal.

Lustre-Die is an outstanding plastic-molding steel because it takes such a bright polish. Its basic analysis is just right for working with plastics. But as a further precaution, we enhance the grade by means of alloy fortification, thus improving its already excellent properties. It comes oil-quenched and tempered, ready for machining and polishing.

Lustre-Die is an electric-furnace steel. Not only does it undergo close scrutiny to insure cleanliness—it is also free from injurious porosity or surface pitting.

Order Lustre-Die for your next plastic-molding job. Your Bethlehem tool steel distributor has a good supply in stock, and is ready to serve you.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

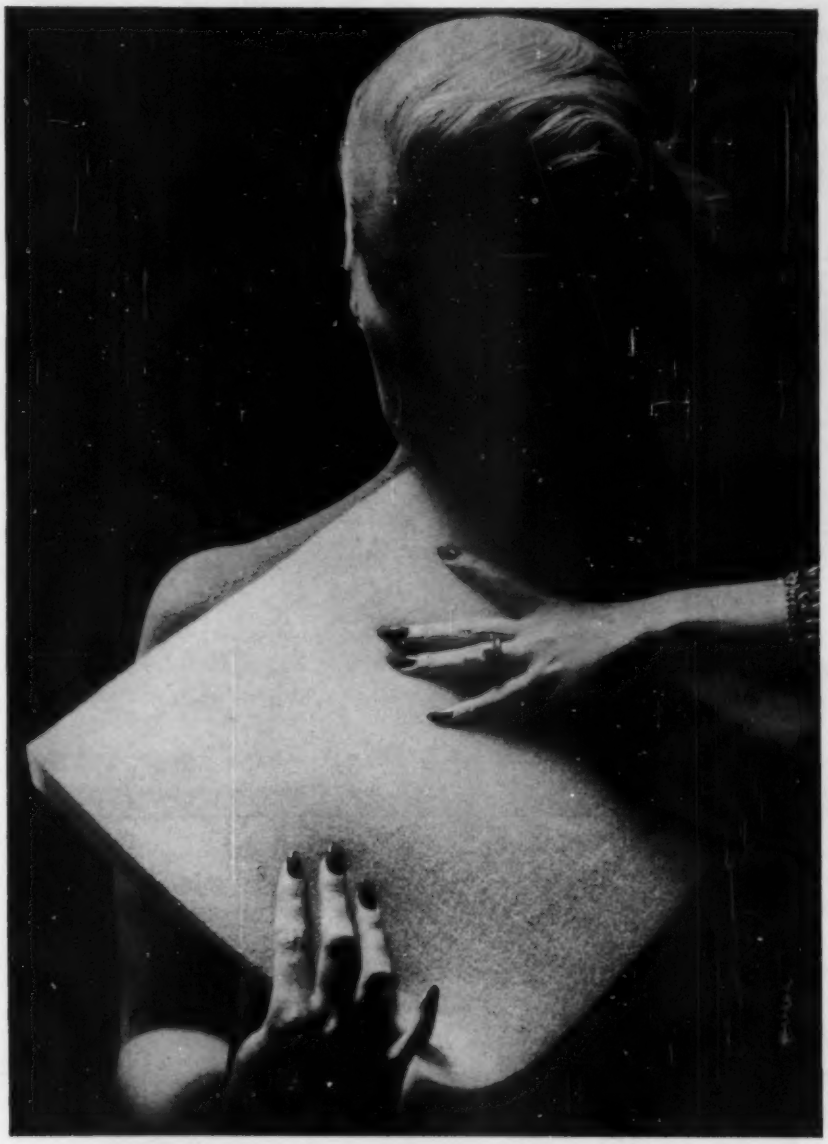
BETHLEHEM STEEL

BETHLEHEM TOOL STEELS

You get the Softest . . . Lightest Urethane Foams from

Selectrofoam®

Pittsburgh's New Type DIMER Polyester Resin



Offers these advantages to manufacturers and users:

- **Densities as low as 1.5 lb. per cu. ft.**
- **RMA compressions down to 8 lbs. where desired.**
- **Fast cure cycle.**
- **Consistent low compression sets.**
- **No prepolymer preparation.**
- **Less chemical supervision.**
- **Better humid aging resistance.**
- **Excellent load-bearing characteristics at lower densities.**
- **More uniform controllable cell structure.**
- **Competitive cost on final foam.**

Now you can produce urethane foams which combine high resilience and luxurious softness with lightest weight from Pittsburgh's new type SELECTROFOAM *dimer* Polyester Resin. And you get all these characteristics at reasonable cost.

● **This new type of resin,** used to make the fluffiest pillows, needs only a simple recipe change to produce cushions of "showroom feel" that give comfortable body support in motorcars, furniture and mattresses. Slab stock from this resin can be readily slit, sewed or die cut for a variety of products such as clothing interliners and carpet underlays. These foams may be embossed, heat-sealed, glued, painted and colored.

● **SELECTROFOAM Resins** are also available in tough, non-friable rigid types. These can be used to make inserts or fillers in structural tubing or channels, as laminates for various kinds of wall construction, in refrigeration wall panels and doors, trailers, airplanes and in other structures where great strength and thermal and acoustical properties are required.

● **For complete technical details** and field information on all types of SELECTROFOAM Resins write Pittsburgh Plate Glass Company, Plastics Department, 1 Gateway Center, Pittsburgh, Pa.

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SYMBOL OF SERVICE FOR SEVENTY-FIVE YEARS

75 ANNIVERSARY 1883 - 1958 PPG PITTSBURGH PLATE GLASS COMPANY

IN CANADA: CANADIAN PITTSBURGH INDUSTRIES LIMITED

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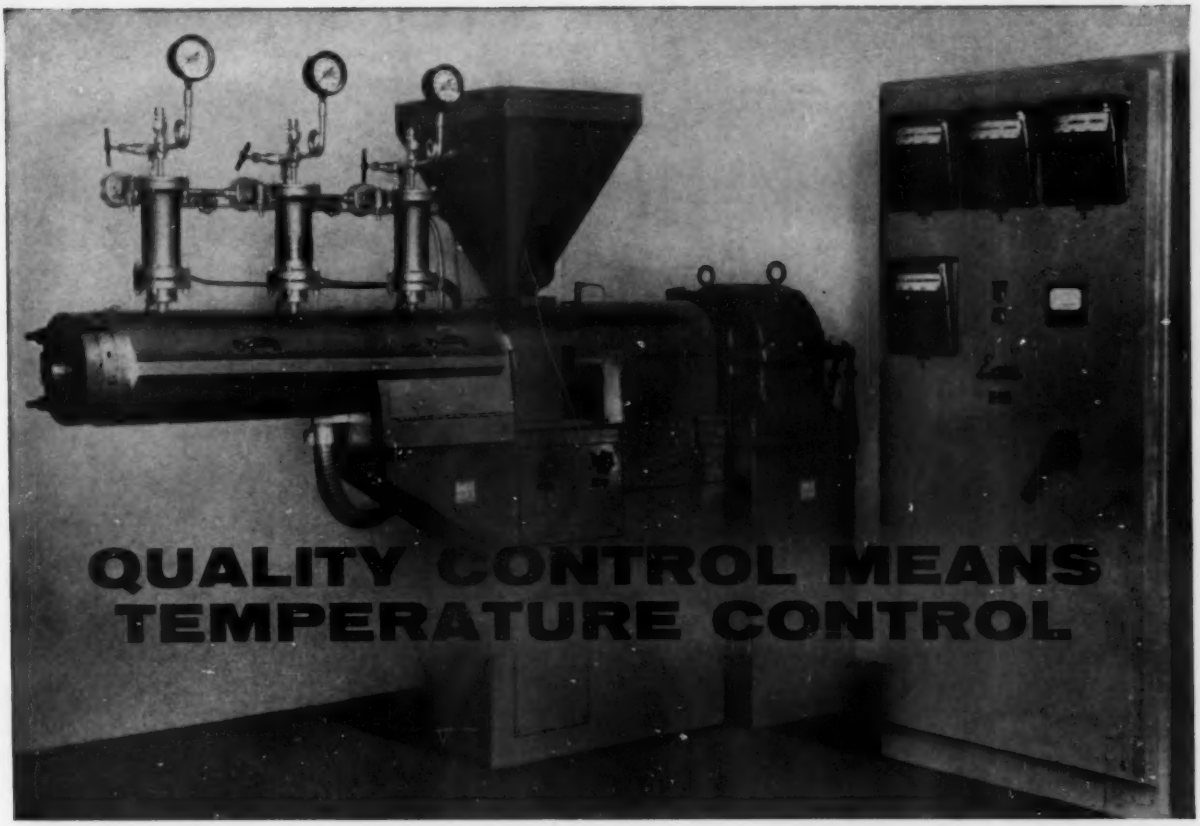
Which of us hasn't put a tooth under his pillow and looked for 6d.? But it's not always wise to rely on a fairy godmother, especially if yours is the more vital search for the right type of polystyrene to suit your own particular needs. The day you contact Kleestron you've found your answer. The extensive research upon which we base the manufacture of injection moulding and extrusion materials makes it highly probable that we can meet your most precise demands. Why not put us to the test — just write or 'phone:

Kleestron Limited

WEST HALKIN HOUSE · WEST HALKIN STREET · LONDON · S.W.1 · TELEPHONE: SLOane 0866

Kleestron make a comprehensive range of general polystyrenes and impact materials — and will gladly supply technical details, prices, etc.



Egan Extruder With "Willert Temperature Control System" Automatically Eliminates Temperature Variations

Heating the plastic material in the extruder cylinder, whether by conduction, induction, or friction, is no problem — assuming the designer has provided sufficient heating capacity and a properly designed screw.

However, provision for efficient dissipation of excessive heat is essential to make any temperature control system complete.

The Willert System is the ultimate in complete control! Excessive heat is removed automatically without moving parts, and without any manual operation of valves or switches by the operator. As a result, closer tolerance extrusions are produced easier and faster.

The Egan Extruder shown above, complete with "Willert Temperature Control System," is available in sizes from 2" through 10". It incorporates standard Egan features such as: herringbone gears, separate heavy duty thrust bearing assembly, complete control panel, wiring, piping, hinged covers for easy access to thermocouples, hopper, screw speed tachometer, and ammeter. Additional features are available.

Write, or Phone Randolph 2-0200,
For Complete Information — No Obligation.

Egan **FRANK W. EGAN & COMPANY**

SOMERVILLE, NEW JERSEY
CABLE ADDRESS: EGANCO — SOMERVILLE (NJER)

Manufacturers of plastics extruders, dies, take-offs, and other accessories

REPRESENTATIVES: MEXICO, D. F.-M. H. GOTTFRIED, AVENIDA 16 DE SEPTIEMBRE; JAPAN-CHUGAI BOYEKI CO., TOKYO.
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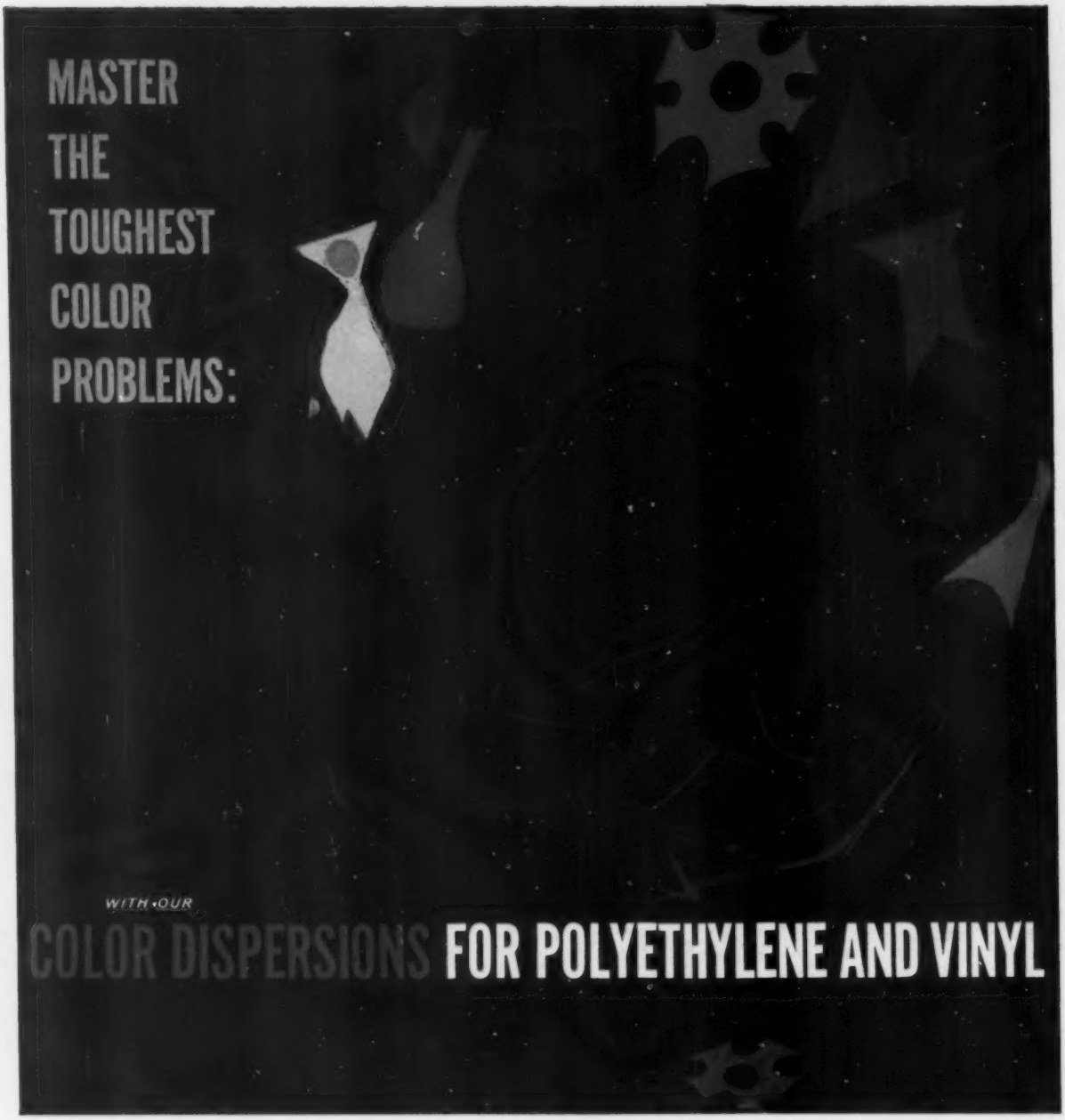

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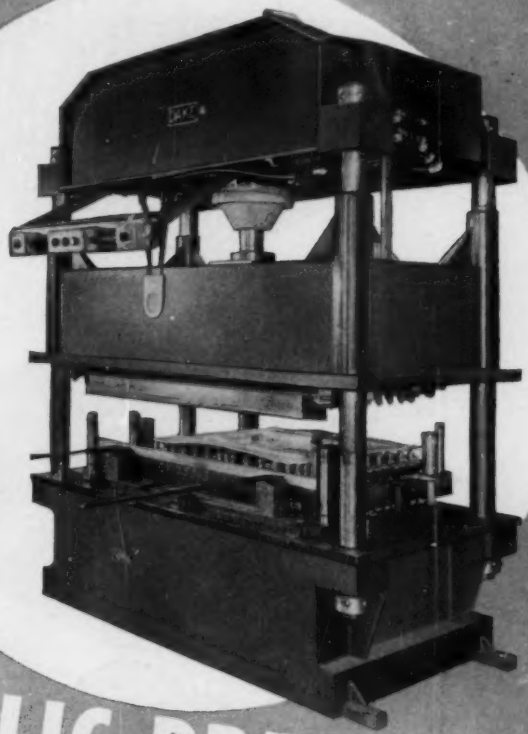
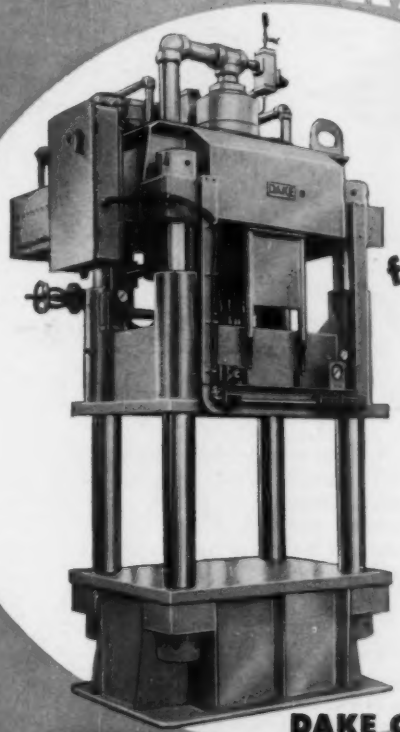
available in standard and custom engineered models



for trimming and piercing vacuum-formed plastics

DAKE HYDRAULIC PRESSES



for molding reinforced plastics

Be a pacemaker in the fast-moving plastics industry with equipment designed to keep production geared to modern trends. Dake Hydraulic Presses speed output and reduce costs. They are job-engineered by men experienced in the plastics industry. These men are ready to help you meet special requirements as well as provide better equipment . . . both for compression molding of reinforced plastics as well as trimming and piercing vacuum-formed plastics. Standard models are electric-hydraulic in operation, with capacities ranging from 25 to 300 tons. They are adjustable for stroke, pressure, temperature and timing. Dual palm-operated controls are standard, providing safety in operation. Dake will gladly work with you in developing whatever special press equipment you need.

For descriptive literature on these presses, write for Bulletins 340 and 352.

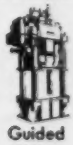
DAKE CORPORATION 648 Robbins Road, Grand Haven, Michigan

DAKE PRESSES


Arbor Presses

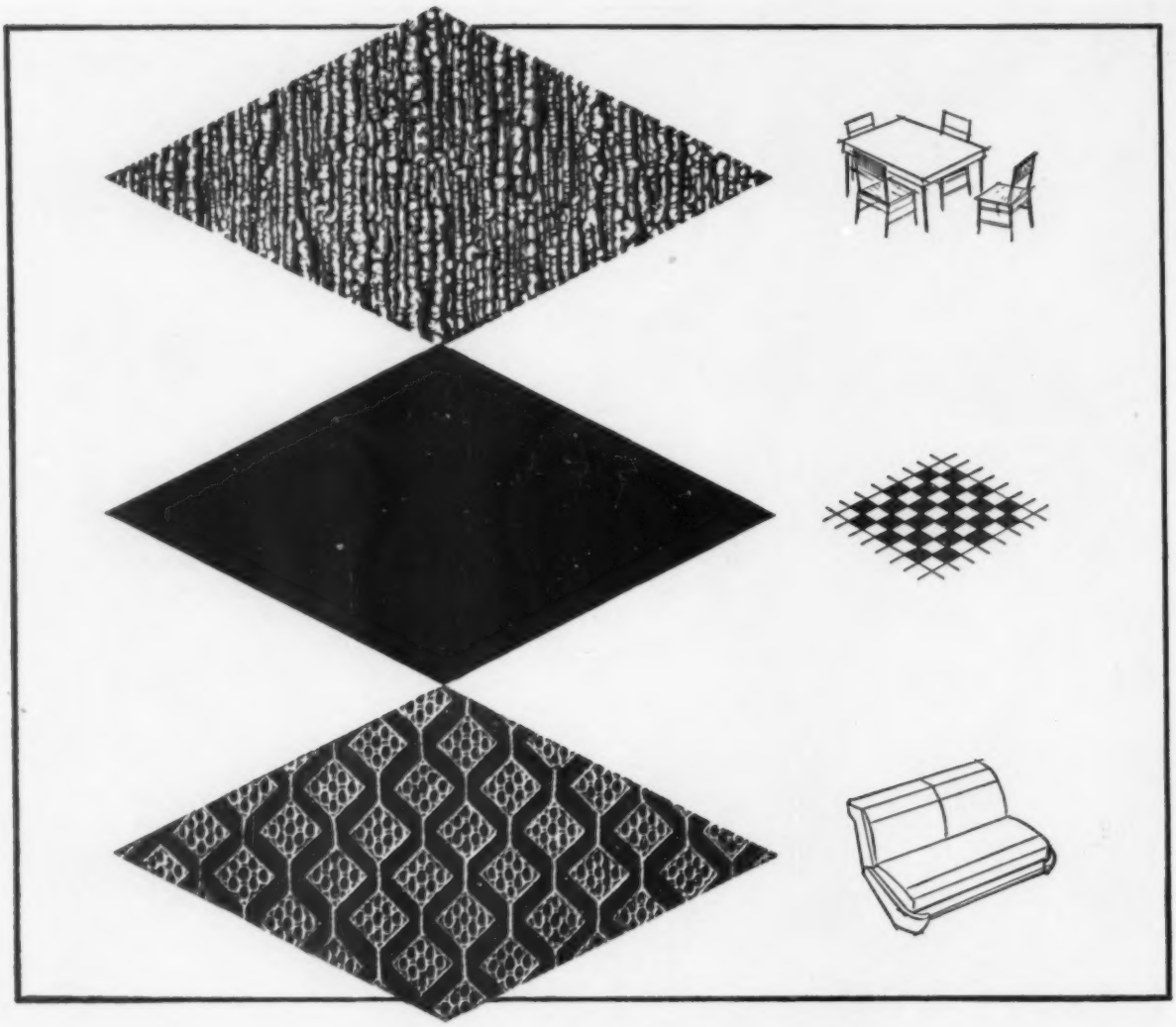

Hand-Operated Hydraulic


Power-Operated Hydraulic


Guided Platen


Gap Type Presses


Movable Frame



Plastolein® 9720 is the answer to low-cost polymeric permanence!

Only a polymeric plasticizer can give your vinyl products the permanence your customers want. And of all polymerics, Plastolein 9720 is the lowest in cost.

You get versatile all-around utility from Plastolein 9720. Outstanding permanence. Easy processability. High efficiency. Excellent compatibility. You get low temperature flexibility that other polymerics fail to match. And the comparatively low viscosity of Plastolein 9720 provides added savings from bulk storage and easy handling.

Remember, Plastolein 9720 gives you polymeric *permanence*, at the lowest possible cost. Get the facts by sending the coupon below.

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Export Dept.: Carew Tower, Cincinnati 2, Ohio

Emery Industries, Inc., Dept. F-8,
Carew Tower, Cincinnati 2, Ohio
Please send 32-page Emeryfacts describing the Plastolein Plasticizers.

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Company_____

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City_____ State_____

Don't miss . . . in this issue

The financial aspects of automation. With more expensive equipment, with higher per-cavity die cost, molders can make more money today. It is a matter of establishing true costs, particularly in tool and machine amortization. Here are actual case histories costed out to show the savings. Size of molded thermoset piece is no longer a problem. As one molder puts it, "nobody now can afford not to automate." See "The dollar value of automated thermoset molding," p. 85.

Filter plates molded from premix. A polyester-fibrous glass premix material is now being used for making low-cost lightweight filter plates for the food and chemical industries. Two molders and a lot of know-how were involved. See "Reinforced plastics filter plates benefit process industries," p. 93.

Acrylic sirup for reinforced plastics. New competitor to the polyesters, particularly in architectural glazing, is an acrylic sirup. It has all the weatherability of acrylic castings and extrusions but has added advantages in optical properties, impact strength, and abrasion resistance. How it is used, with what reinforcements, and for what purposes are discussed in "Reinforced molding with acrylic sirup," p. 109.

Carbon black in polyethylene. To protect polyethylene from attack by sunlight, carbon black is dispersed in the resin. New procedures and equipment are now used to evaluate the degree of dispersion and thus to predict weatherability. See "Evaluation of carbon black dispersions in polyethylene to predict weatherability," p. 125.

Battery-powered musical toys. Following a policy of upgrading the toy markets with products not subject to cheap foreign competition, American plastics toy manufacturers are engineering ingenious new products. This article tells how two of these high-ticket musical toys, a bell organ and a xylophone, were developed. See "Motored musical toys," p. 102.

Plastics' stake in the shoe business. Around 600,000,000 pairs of shoes are made and sold in the United States each year. In the past five years plastics have moved into this important market as hidden components as well as in heels, soles, and uppers. Three million lb. of polyethylene and four million lb. of acetate, as well as quantities of acrylic, vinyl, nylon, butyrate, and styrene alloys will be used this year in shoes. The application trends, the design problems, and current fabricating methods are outlined in "Plastics stake in footwear," p. 90.

Polyethylene sheet for thermoforming. Recognized as a profitable market for polyethylene, the sheet thermoforming field is far from easy to invade. First, tailor-made resins have to be produced. Then heating and cooling equipment must be created expressly for this material. A tremendous volume business awaits in a wide number of end uses, particularly in packaging. Here is the presentation of all the factors involved. See "Choosing and forming polyethylene sheet," p. 113.

Markets for reinforced plastics pipe. As compared with thermoplastics pipe, the research and engineering problems involved in making reinforced plastics pipe have been tremendous. These are composite materials created to withstand high temperatures, high pressures, and severe attacks by chemicals. This, the second article in our series on pipe markets, shows all the methods being used, lists the materials involved, and points up the pattern of progress. See "Reinforced plastics pipe progress," p. 96.

Polyethylene is a seaworthy plastic. Since polyethylene floats, and since it can be molded, extruded, thermoformed, and foamed, it is a natural for many marine applications. Replacing non-plastics materials in such applications as bilge pumps, boat fenders, and ropes, it gives superior performance at lower cost. See, "Polyethylene for marine applications," p. 94.

Watch for... our September lead feature which will be an analysis and comparison of methods for coating web materials with plastics. The reader will be enabled to select the most efficient coating method for a given product and for a specific type of coating . . . the third article in our pipe series, this one on markets for rigid vinyl pipe . . . the story on plastics tarpaulins and airhouses . . . a new method of coating metal sheets with decorated plastisols . . . a feature on progress in polyolefin applications . . . the November pre-Plastics Show issue, the theme of which will be "Plastics for profits," and which will contain scores of case histories of the profitable use of plastics in many fields.

MODERN PLASTICS
Volume 35
August 1958
Number 12

The dollar value of automated thermoset molding

The word most frequently heard from management today, "automation," is probably the most thoroughly misunderstood in terms of economics. This is particularly true of automatic molding processes for plastics. Traditional methods of cost accounting, ancient policies of equipment and tool write-off, historic approach to overhead mark-up, are all due for reappraisal. Automation brings with it a new management philosophy and a new set of definitions and values.

Here are 10 points of misunderstanding in this matter.

1st there is the raw opinion that the only purpose of automatic molding is to save labor costs. This is partly true, since the savings in labor permits molds to be tailored to production requirements. With today's equipment, one man (at $1.80/hr. average) can run 10 or more automatic compression presses. But you need much higher caliber foremen, supervisors, and/or set-up men for an automatic plant.

2nd is the belief that the main purpose of automatic molding is speed of production and therefore that it fits only long runs. Again, this is only partly true as will be shown in an example below. Costing the equipment, the tools, and the operation *to the annual requirement of*

CASE HISTORY A

MOLDER
Southern Plastics Engineering Corp., Greensboro, N. C.
PRODUCT
Electric blanket control for Fieldcrest Mills
MATERIAL
Cotton flock phenolic, in nodular form
PRESS
50-ton Automold
RESULTS
Labor costs cut from $7.62 to $1.01 per 1000 pieces

CASE HISTORY B

MOLDER
Wama Co., Baltimore, Md.
PRODUCT
Terminal block
MATERIAL
Special phenolic
PRESS
Stokes 25-ton automatic, 3 cavities
RESULTS
On 500,000 parts, manufacturing costs cut from $12,100 to $4645. Machine days cut from 272 on 50-ton semi-automatic to 244 on automatic

CASE HISTORY C

MOLDER
The Hoover Co., North Canton, Ohio
PRODUCT
Vacuum cleaner parts
MATERIAL
General purpose phenolic
PRESSES
Two 150-ton Baker automatics, 2-cavity molds
POWDER HEATERS
W. La Rose & Associates
RESULTS
Labor costs dropped from 1¼ manhours to 1/10 manhour per 100 parts. Savings $7500 per year

Case history of an electrical part

PRODUCTION DATA

Type press (automatic)	Annual requirements	Cycle (in sec.)	No. of cavities	Production per hr.	Production per 24-hr. day	Machine days to meet requirements	Machine hours per 1000
25-ton	100,000	54	2	133	3,030	33.0	7.5
50 or 60 ton	100,000	57	2	126	2,870	35.0	7.9
50 or 60 ton	100,000	57	4	252	5,750	17.4	4.0
25-ton	1,500,000	54	2	133	3,030	495.0	7.5
50 or 60 ton	1,500,000	57	4	252	5,750	260.0	4.0
125-ton	1,500,000	59	9	550	12,500	120.0	1.8

[a] Per-hour and per-day production at 95% efficiency. Labor at $1.80/hr. 18¢/hr./press (one man to handle 10 presses). Heat and power at 2.5¢/kwh. Tools to be amortized over two years. Presses to be amortized over seven years.

Case history of an electrical part

PRODUCTION DATA

Type press semi-automatic	Annual requirements	Cycle (in sec.)	No. of cavities	Production per hr.	Production per 24-hr. day	Machine days to meet requirements	Machine hr. per 1000
50-ton	100,000	40	4	360	6,900	14.5	2.8
100-ton	1,500,000	45	8	640	12,300	122.0	1.6

[b] Per-hour and per-day production at 80% efficiency. Labor at $1.80/hr., one man to one press. Heat and power at 2.5¢/kwh. Tools to be amortized over two years. Presses to be amortized over seven years.

a given job is the only way to arrive at a *true* picture of the dollar value of the automatic process—or, for that matter, of any process.

3rd is the belief that maintenance costs are extremely high on automatic equipment. In case after case it has been proved that a properly tuned machine is easier on itself than an operator would be, and that while high-caliber maintenance engineers are required, the cost of their services per machine per working hour is lower than that of less skilled mechanics on non-automatics.

4th is the argument that since automatics require better and more expensive materials (see, "Advances in thermoset molding," MODERN PLASTICS, *33*, 145, May 1956 and "Properties required of thermosets for automatic molding," MODERN PLASTICS, 35, 104, July 1958) the part cost relationship to material cost may be so high as to offset savings in labor. This is false. The automatic machine wastes much less material than even a semi-automatic. Rejects are inevitably cut. Pieces are identical. And modern accounting for automation shows that raw material costs are the least important factor in the picture.

5th is the matter of changeover. Improvement in presses and also in preheating equipment over the past few years has cut mold change time in half. Today even a big job can be changed in three or four hours.

6th is the old shibboleth on mold costs. It

molded automatically[a]

COST DATA

Labor, heat, power cost per 1000	Overhead cost per 1000 300% direct labor	Mfg. cost ($)	Tool amortization ($)	Press amortization ($)	Total Mfg. cost ($)
2.03	4.05	608	2750	120	3478
3.00	4.25	725	2900	220	3845
1.52	2.15	367	5400	109	5876
2.03	4.05	9100	5500	1810	16,410
1.52	2.15	5500	5400	1640	12,540
1.13	.97	3150	11,750	1230	16,130

25-ton press —$6400. 50- or 60-ton press—approximately $11,000.
125-ton press—$18,000.
Material costs not included.

molded semi-automatically[b]

COST DATA

Labor, heat, power cost per 1000	Overhead cost per 100 100% direct labor	Mfg. cost ($)	Tool amortization ($)	Press amortization ($)	Total Mfg. cost ($)
5.87	5.05	1092	5000	145	6237
3.62	2.88	9750	9800	1470	21,020

50-ton semi-automatic press—$9500. 100-ton semi-automatic press—$13,000.
Preheater—$3000. Preformer—$5000.
Material costs not included.

Electrical part on which were based the cost studies detailed in the accompanying article and presented in tabular form at the left. (Photo. F. J. Stokes Corp.)

is true that a mold for automatic thermoset molding can cost anywhere from 25 to 100% more per cavity than even a semi-automatic mold. But you need fewer cavities for the same production. And, as will be shown below, a thorough analysis of total production costs will frequently indicate that an automatic press may more profitably be underloaded than used to capacity.

7th is the old custom molding conception of tool amortization. With automation it is no longer none of the molder's business how much of a tool is written off in a given length of time. It is part of the production cost picture.

8th is the matter of press flexibility, a misunderstanding of which has caused many custom molders not to automate. Flexibility is the most important thing modern automatics have to offer. They can do anything that non-automatics and semi-automatics can do, and their controls are most precise.

9th is the old story of equipment *in situ* that must be used even if it is not properly charged for on the job. This is a snare and a delusion and is one of the best methods a molder can use to lose money.

10th is the matter of piece size. Again, automatics developed in the past few years can now mold big pieces. Many 150-ton presses, equipped with automatic powder preheating, are today turning out parts that previously would have had to be manually molded. 450-

ton automatics have been in operation for over a year. Still bigger ones are on the drawing boards, and bigger preheaters are on the way.

Basic study in values

An important lesson in the economics of compression press automation is to be learned from the basic study charted on p. 86.

Not germane to the manufacturing cost as expressed in press, tool, labor, heat, power, and overhead is the material and the weight of the part, since these tend to be only leveling factors.

The important thing here is the relationship between tool and press amortization and total annual cost of production. It will be seen that 100,000 parts are produced at a lower total manufacturing cost in a two-cavity mold on a 25-ton automatic press than by any other means. It is cheaper to produce 100,000 parts in a two-cavity mold on this press than to use a four-cavity mold in a 50-ton automatic press. And it is also cheaper to produce this number of parts in a two-cavity mold in a 50-ton press than in a four-cavity mold on the same press. This is a good demonstration of why the number of cavities should be tailored to the production requirements rather than to the size of the automatic molding machine.

On the other hand, when we come to an annual requirement of 1½ million parts, the 50-ton automatic press with a four-cavity mold works best. The extra production days would be easily run in during vacations or on Saturdays due to the fully automatic operation.

Also shown are cost data on the same part molded on a semi-automatic press. Note that the 50-ton automatic, four-cavity total tool and press amortization is $7040, which is much less than the $9800 tool amortization alone on the 100-ton semi-automatic press. In addition, note that the manufacturing cost on the 50-ton automatic, four-cavity job for the 1½ million run is also lower. This means that regardless of how large a semi-automatic press was selected, the total of the two costs of manufacturing and amortization could never possibly be as low as the same total costs on the 50-ton automatic.

These calculations are most generous in many respects. The overhead rates of 300% on automatics and 100% for direct labor on semi-automatics will vary from plant to plant, so an average has been struck. Many custom molders amortize tools over one year instead of two, so the use of a two-year amortization makes the automatic less attractive than would one-year amortization. Some companies amortize presses over 10 years rather than seven, but since that is a relatively small portion of the total cost, the picture would not be changed seriously.

It may come as a shock to molders who have not studied out amortization costs to learn this lesson: on a short run it can be cheaper to underfill an automatic press than to use its whole capacity.

The piece shown with the tabulations on pp. 86 and 87 and described in this basic production cost study is currently running in three shops. This is no fairy tale.

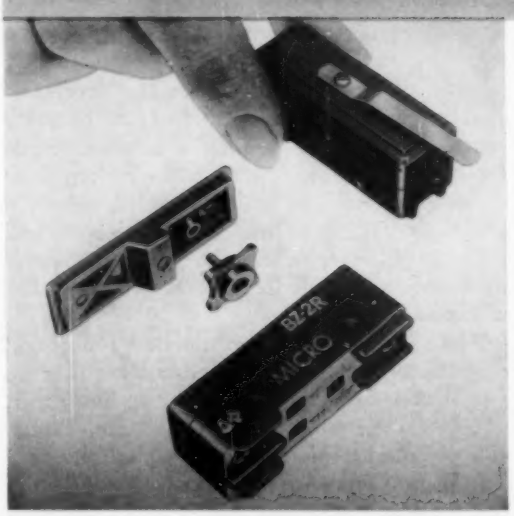
Other case histories

Space does not permit such a detailed production cost analysis of even the small selection of case histories presented herein. But the formula is rapidly becoming standard in the field and may be applied to any job for which automation in thermoset molding is being considered.

The claims made by proponents of automatic molding frequently seem fantastic to the uninitiated and to the bigoted. But detailed cross-checking by MODERN PLASTICS editors shows that in many cases the claims of cost saving or money-making are *understatements*, particularly if translated into five- and 10-year periods.

A case in point is an operation at the Micro-

Case history of a switch part



Switch Div. of Minneapolis-Honeywell Regulator Co., Freeport, Ill. The company's products are precision snap-action electrical switches. In a single year the company will use 40 million parts in the 10,000 models of switches cataloged. Needed was a molding process that could be kept under close control, would be easily adjustable for changeover to other molds, and would be fully automatic.

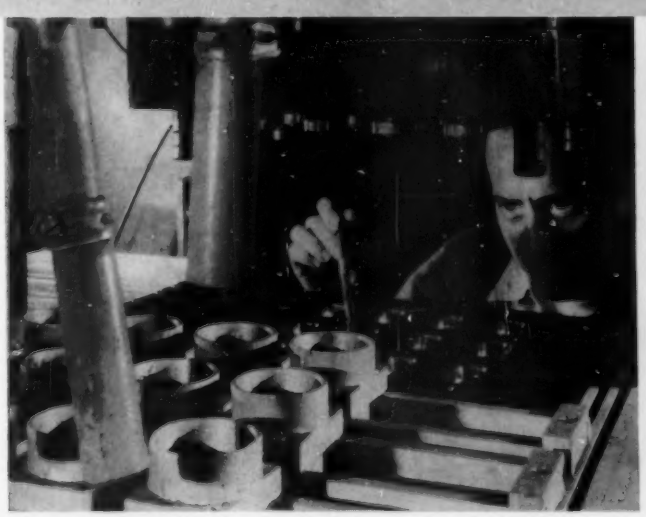
The components (see photos below) were previously bought for $11.75/1000 from a custom molder who was using a 24-cavity mold in an available, but oversized, 200-ton semi-automatic press that required half a man's time. A greater demand for these parts required a ⅔ increase in production and it was decided to make a 40-cavity mold. When cost studies showed that considerable savings were likely if the company were to do the molding themselves in a 60-ton automatic press, they went ahead with the installation.

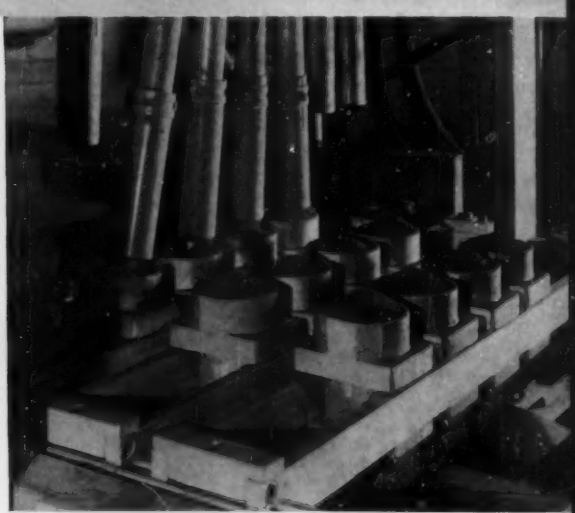
The automatic press cost $12,000, the mold $10,000, and operation required only a quarter of one man's time. The total costs of production — material, direct labor, power, amortization, and all overhead — amounted to $2.54 per 1000, less than one-fourth of the old purchase price. While part of this saving was due to elimination of the custom molder's mark-up, there were important savings in labor and machine amortization costs. (The increased dollar cost of the mold was almost offset, on a unit basis, by its 67% larger output.) Another—not very obvious—source of saving was the ability of the automatic machine to run itself during lunch hours and coffee breaks, making a gain over semi-automatic operation of about 14% in operating time at no additional labor and overhead costs.

Another example is illustrated as Case History A on page 85. This is a component for an electric blanket temperature control for Fieldcrest Mills and is molded by Southern Plastics Engineering Corp., Greensboro, N. C., one of the very few custom molders employing mainly automated equipment. The item, costed out on a semi-automatic 100-ton press with a four-cavity mold, involved a total equipment investment of $21,600—the press would cost $8500, the preformer $4000, the preheater $4000, and the mold around $5100. The job running on a fully automatic 50-ton press with a three-cavity mold involves equipment costing only $11,550: $7000 for the press and $4550 for the mold.

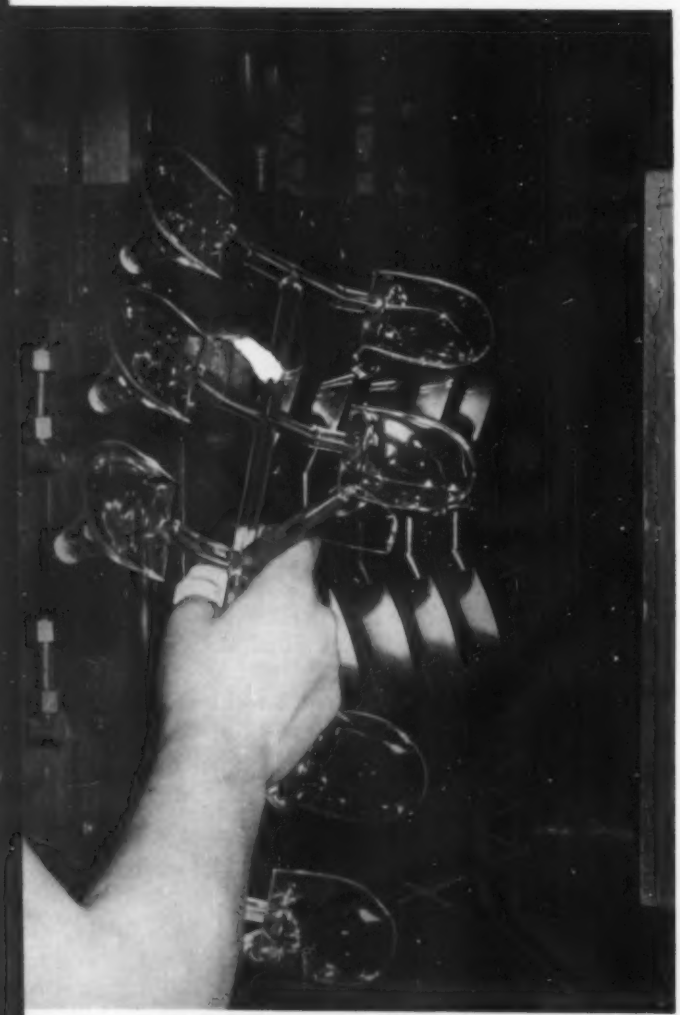
This molder figures his labor cost at $1.60/hr. and his automatic equipment at 85% of efficiency. The semi-automatic process would produce 210 parts/hr. at a labor cost of $7.62/1000 pieces. Figuring one tenth of a man per press on the fully automatic operation, production is 158 pieces/hr. at a (*To page* 182)

Left: Two of the 10,000 models catalogued, showing actuating pin molded into center component of exploded view. Below: Waxing a 12-cavity mold for switch bodies on a 60-ton automatic brace. Below: Accurately measured thermoset molding powder enters the feed cups. Details of this molding job are in text above. (Photos, Baker Bros. Inc.)





PLASTICS'



Plastics heels for women's dress shoes, produced by injection in multi-cavity molds, represent a rich market for thermoplastics in the footwear industry. Heels shown are of butyrate. (Photo, Eastman)

In the past few years, plastics have carved out a handsome slice of the huge footwear market. Footwear is a major U. S. industry, with annual production in the neighborhood of 600 million pairs of shoes—three and a half pairs of shoes for every man, woman, and child in the country. At an average factory price of $3.62 (U. S. Bureau of Labor Statistics) for each pair of shoes, footwear adds up to a $2 billion industry at wholesale.

Plastics applications in this rich market are highly diverse. Most of the thermoplastics share in the business—acrylic, acetate, butyrate, polyethylene, vinyl, and, to a lesser extent, nylon, polypropylene, and polystyrene.

Heels the biggest market

Probably the largest poundage application for plastics in footwear is in women's dress shoe heels. This is a large market, since women buy some 275 million pairs of shoes a year, or 4.63 pairs per capita. Transparent acrylic was the first plastic used for women's shoe heels, and it enjoyed a good market. However, an inherent limitation was that the material could not be nailed to a shoe upper, and more expensive means of attachment had to be used.

This problem does not exist with acetate,

Nylon lifts, molded of caprolactam nylon by Jamison Plastic Corp., N. Bellmore, N.Y., are said to outlast leather shoe lifts several times. (Photo, Catalin Corp.)

STAKE IN FOOTWEAR

Two billion-dollar industry offers diversified

outlets for practically all thermoplastics

which made its first big-volume appearance in 1956. These plastic heels look better, last longer, and, unless highly decorated, are less expensive to produce than the wood heels they replaced. In 1957, molded plastics heels, mostly acetate, were used on more than 50% of all women's dress shoes.

In 1958, an even larger portion of women's shoe heels will be of molded plastics, though acetate's percentage of the market may dwindle because acrylic has come back in a new form: Implex, an opaque, impact-resistant material developed by Rohm & Haas which overcomes the handicaps of the earlier material.

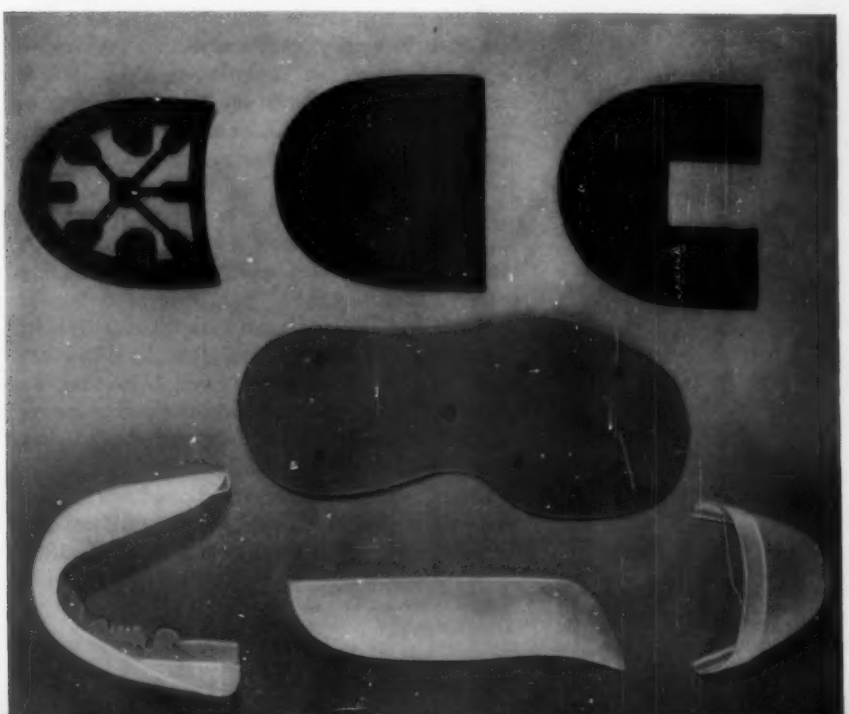
Despite substantial inroads by Implex, acetate remains the most important plastic in women's shoe heels. Celanese Corp. of America estimates that women's dress shoe heels will absorb more than 4 million lb. of acetate this year. Since a pound of resin will make 10 heels (five pairs), some 40 million acetate heels will be produced this year.

The next important plastic in the heel picture is butyrate. Two producers of shoe heels are using this material despite its higher cost over acetate because it has greater strength, cycles faster, and yields 6 to 7% more heels to the pound because of its lighter weight.

Other plastics besides these three are in the running. The first volume order for polypropylene was for women's shoe heels. Styrene and ABS (acrylonitrile-butadiene-styrene) are also being used for women's dress shoe heels on an experimental basis.

Polyethylene in shoe parts

Polyethylene has a big and growing role in the shoe industry. The material is used to produce half a dozen shoe parts, mostly for men's shoes: counters (stiffening members in back of shoe upper); heel bases; inserts (parts which form arch of shoe); midsoles; Dutchmen (parts under heelbases which are continuations of the sole); and box toes (stiffening members in toe). These products (see photo, below), turned out on fast cycling injection molding machines, are



Polyethylene yields excellent, highly uniform integral shoe parts. Illustrated (left to right, top to bottom) are: heelbase, Dutchman, cutout Dutchman, midsole, counter, insert for shoe arch, box toe. (Photo, Endicott Johnson)

Decorated heels

At left: Metallized acetate heels. (Photo, Celanese.) Above: jeweled butyrate heels. (Photo, Eastman.) At right: Heels molded of impact-acrylic are covered with leather. (Photo, Rohm & Haas)

replacing leather or fiber. Molded polyethylene in all cases yields a better, more uniform product, and in heel bases, inserts, and midsoles, a less expensive product as well.

Endicott Johnson Corp., Johnson City, N. Y., has been producing these molded polyethylene parts in monthly quantities like these (pairs): Dutchmen, half a million; counters, 300,000; heel bases, 190,000; inserts, 100,000; midsoles, 41,000. Endicott Johnson alone uses some 80,000 lb. of polyethylene per month. Estimates are that the whole shoe industry uses about 3 million lb. per year. The potential for molded polyethylene shoe parts is nothing less than every shoe in America.

With heel bases and Dutchmen molded of polyethylene, the next logical step is to mold the entire heel of the material. Heels for children's shoes are being molded on an experimental basis from blends of conventional and high-density polyethylene. If these heels prove satisfactory, it may mean a greatly increased market for polyethylene in footwear.

Where vinyl fits in

Vinyl is also in the shoe field. Vinyl sheeting is used to make the uppers for women's transparent dress shoes. These clear dress shoes have fallen from the rank of a top fashion accessory, but they have become well established as a women's wardrobe staple—a shoe that will match any dress—and enjoy a steady market that goes on year after year. Vinyl sheeting has further use in the women's shoe field as a reinforcing material for light leather straps in women's play shoes. The clear vinyl sheeting is used under the leather and is concealed by it.

Vinyl foam is used by one major manufacturer to produce innersoles for men's, women's, and children's shoes, which have outstanding comfort advantages.

Molded nylon also has a toehold in footwear; the material is being used for the lift—that part of a woman's shoe heel which touches the ground. Nylon lifts, injection molded in many different sizes and colors, are reported to last four times longer than leather.

Though all the plastics mentioned are important in the shoe field, perhaps the greatest advance in plastics footwear manu- (*To page* 186)

Footwear, completely molded of PVC and polyethylene, produced by new extrusion molding process. (Photo, Utrilon Corp.)

Reinforced plastics filter plates benefit process industries

Molded polyester premix is now meeting a long-standing need for low-cost, lightweight, chemical-resistant filter plates for use by the food, chemical, and other process industries. Developed by T. Shriver & Co., Inc., Harrison, N. J., manufacturer of pressure filters, the new plates offer a combination of advantages not attainable heretofore with a single plate material. The accompanying table illustrates how the molded polyester plates compare with plates made from other materials in terms of chemical resistance, price, and weight. As noted, the molded plates can handle a wide variety of corrosive materials. In addition, they are especially interesting to the dyestuff industry because of their long life; the wooden plates commonly used in this work require frequent replacement.

The weight savings are especially impressive. In terms of an average 30-plate 36-in. press, they amount to between 2 to 3 tons over coated cast iron. Filter presses are generally opened and the plates separated several times a day to remove filter cake; the light weight of the polyester plates brings obvious handling advantages.

Physical properties are reportedly good (flexural strength of 15 to 20,000 p.s.i., impact strength between 10 to 15 ft.-lb./in. of notch). Recommended upper service temperature is 200 to 250° F., which is appreciably higher than is possible with PVC- or rubber-coated cast iron plates.

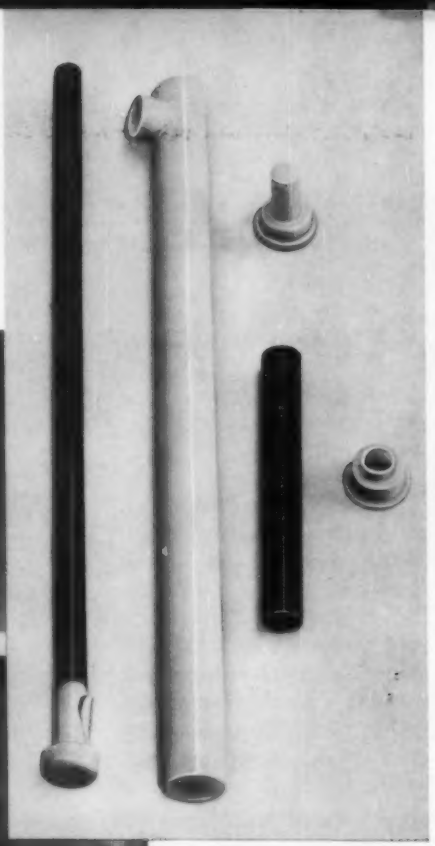
Machining is easy, so that mating surfaces of the plates can be ground to high smoothness and parallelism.

The plates are compression molded by U. S. Rubber Co., Passaic, N. J., and others, of Thermaflow 100 reinforced polyester premix molding material produced by Atlas Powder Co., Wilmington, Del. The plates are offered in 24-, 30-, and 36-in. sizes. Effective filtration area for the 36-in. plate is approximately 16 sq. ft., which is the same as for this size plate made of the other materials listed in the table shown at the right.—END

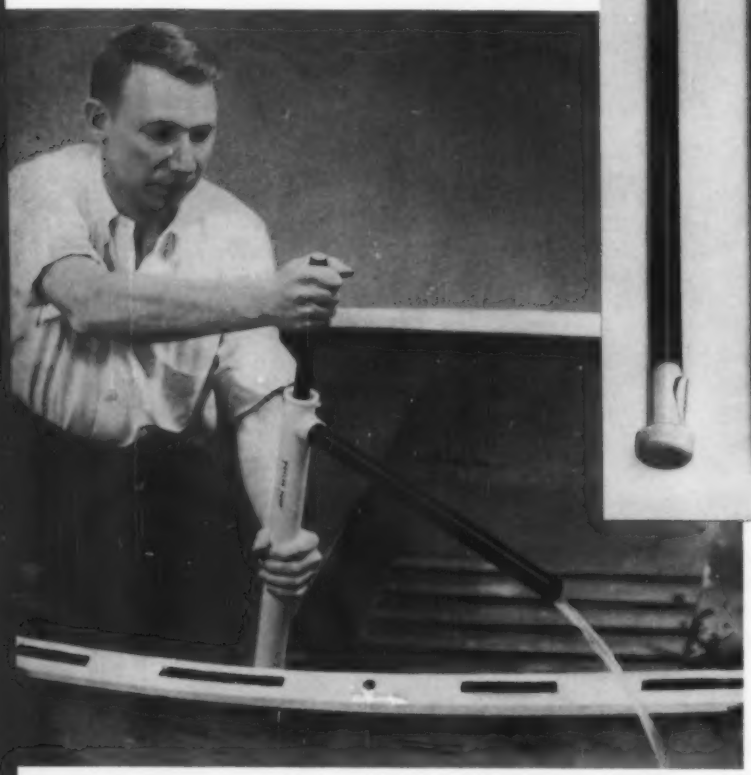
Light weight of molded polyester filter plate —only ⅓ that of cast-iron plate—facilitates handling. (Photo, Atlas Powder Co.)

Cost, weight, properties of various filter plates

Material	Chemical resistance	Weight (based on 36-in. plate)	Cost (based on 36-in. plate)
		lb.	$
Reinforced polyester	Can handle hot mineral acids, alkalies, hypochlorites, peroxides, chlorides, alcohols, carbon tetrachlorides, and other solvents	75	160
Stainless steel	Cannot handle hydrochloric acids and other chlorides	200	540
Aluminum	Can handle only neutral solutions	80	60
Cast iron, bronze, etc.	Essentially the same as reinforced plastics. Provided it is PVC- or rubber-coated	200	180



Components of polyethylene bilge pump (left to right): extruded high-density handle with molded low-density fish-gill valve at bottom; extruded high-density pump body with welded-on low-density spout; molded low-density fish-gill foot valve, which fits into bottom of pump body; extruded high-density extension; molded low-density pump-body cap. (Photos, Grace Chemical)



Bilge pump in action. Water is delivered on up and down strokes

Polyethylene

Two recent entries in the marine accessories field highlight polyethylene's role as a material of major importance in this market. They are an all-polyethylene bilge pump and an all-polyethylene boat fender.

The total number of pleasure craft of all types in the United States at the end of 1957 was estimated at 7,070,000 by the National Association of Engine and Boat Manufacturers. The same source places unit sales for 1957 at about 400,000. Spokesmen of the boating industry anticipate a relatively unchanged volume for 1958.

Bilge pumps

The materials with which polyethylene is competing in this immense market are galvanized metal, aluminum, and brass. Price-wise the situation is as follows:

A galvanized bilge pump 25 in. high and delivering 7 gal./min. retails at $3.75; equivalent aluminum models sell for $5.75; brass pumps 24 in. high and delivering about 8 gal./min. are priced at $28.50. The polyethylene pump, introduced by Edward M. Melton Co., New York, N. Y. under the tradename Trylon, is 24 in. high, is rated at 10 gal./min., and lists for $6.95, including an 18-in. extension that can be used to either increase the height of the pump or to lengthen the spout.

What makes the polyethylene pump truly competitive — in addition to its price position and superior performance — are a number of collective advantages not found in metal pumps.

1) The relatively soft surface of the polyethylene pump will not mar the boat's finish.

2) It is lighter in weight (about 10 oz.) than the others; when dropped, it will not injure user or boat.

3) Being lighter than water it will not sink if dropped overboard.

4) The 18-in. extension stores in the main

body of the pump and is readily available when needed. Separate extensions for other pumps are often lost.

5) The pump is not affected by exposure to water (sea or fresh), oil, and gasoline.

6) Fish-gill valves in both piston and foot make possible delivery of water on both the up and down stroke.

According to Melton, the pump was operated for a total of 100 hr. at the 1958 New York Boat Show, without showing any sign of wear. (For a recently introduced vinyl bilge pump, see p. 106.)

Boat fenders

Foamed polyethylene is the latest entry in the boat-fender field, in which a variety of other materials are already in competition. Introduced by Chapman Water Sports Equipment Co., Costa Mesa, Calif., under the tradename Zephyr, the new fender has a cylindrical body of foamed polyethylene, a braided polyethylene line, and molded polyethylene end caps. The braid is run through the entire length of the cylinder and is turned into a loop at each end.

Competitive fenders are made of molded rubber, cork-filled cloth, kapok-filled canvas, rope, canvas with inner tube, sponge, etc.

Based on a fender 4 in. in diameter and 16 in. long, approximate prices are:

Canvas with kapok filling—$4.50; cork-filled cloth—$5.00; molded rubber—$6.50; rope—$6.00; canvas with inflatable tube—$15.00; foamed polyethylene—$3.00.

In addition to the price advantage, the polyethylene fenders offer other benefits as well.

1) They do not soak up water and have no stuffing to waterlog.

2) They are always ready for use, need not be inflated or deflated.

3) Their resiliency is sufficient for practically all service conditions: they do not tear.

4) They do not mar paint on boat hulls.

5) Since end loops go all the way through the fender, they cannot pull out.

Conclusions

The marine accessories field appears to be a natural for polyethylene. In addition to the applications mentioned, it is already being used for ring buoys, buoyant vests, and life belts; and both price and property considerations suggest many additional uses.

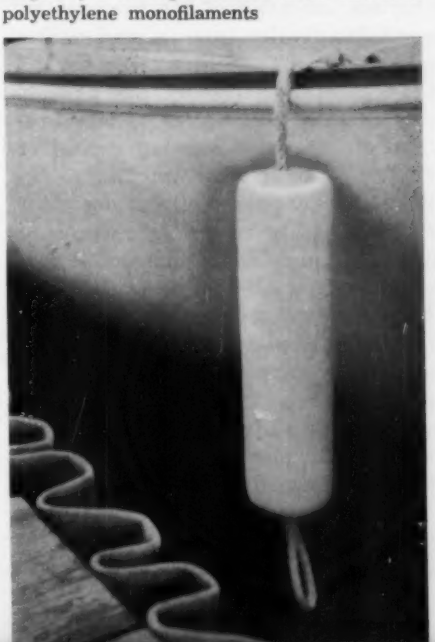
Credits: Pumps—Fabricated by Trylon Chemicals, Inc., Lock Haven, Pa.; molding by Plastivac Corp., Montgomery, Pa., using Bakelite low-density polyethylene; extrusion by Hall Mfg. Corp., Hackensack, N. J., using Grace high-density Grex polyethylene. Fenders—End caps molded by Rainbow Plastics, El Monte, Calif., of Du Pont Alathon 14 low-density material; line manufactured by Puritan Marine of Louisville, 1205 Washington St., Louisville, Ky., of Phillips Marlex high-density polyethylene extruded by Dawbarn Bros., Inc., Waynesboro, Va.

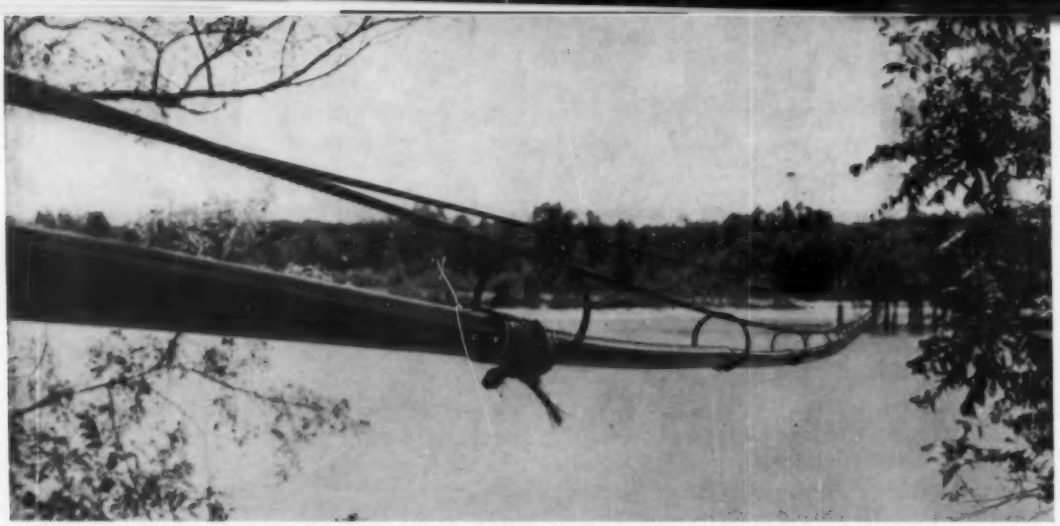
High- and low-density materials—molded, extruded, foamed, and welded

—make strong bid for luscious boat accessories market

for marine applications

All-plastics boat fender has main body of foamed polyethylene, end caps of molded polyethylene, and loops braided from extruded polyethylene monofilaments





Five hundred-foot river crossing of 2-in. reinforced plastics pipe. (Photo, Fibercast)

Reinforced plastics

Few industries have spent more money and effort on research and development in little more than a decade than has the reinforced plastics pipe industry.

It started as a "pipe dream" in 1947 when steel for oil field tubular goods was in short supply and when the U. S. Corps of Engineers sponsored the development of reinforced plastics for invasion pipe.

Since then a known $7 million of government and private funds have been expended on research. This does not take into account many smaller expenditures made by firms no longer active, and research expenditures by material suppliers. An estimate of $10 million may be closer to the fact.

These figures indicate that the financial resources needed to develop, produce, and market reinforced plastics pipe and fittings are beyond the garage-type operation which has plagued the soundly operated thermoplastics pipe producers. The often quoted starting capital of $20,000 or $30,000 for small thermoplastics extruders would hardly open the front door to a reinforced pipe quality control laboratory, to say nothing of the plant and equipment to produce the pipe.

As of this year there are four manufacturers marketing reinforced plastic pipe. They are, in the order of their entry into the market, the following:

Fibercast Co., now a Div. of The Youngstown Sheet and Tube Co., plant located near Tulsa, Okla. This is outgrowth of work that was started in 1947 by H. D. Boggs Co., Ltd. plus 1950 through 1953 Perrault Bros. developments, then acquired and further developed by The Youngstown Sheet and Tube Co., Youngstown, Ohio.

Spiral-Glas Pipe Co., *Spiral-Glas pipe*, developed by Carl de Ganahl. Plant located in New Brunswick, N. J. Work on this project was begun in 1950.

Minnesota Mining & Mfg. Co., *3M pipe*, developed by Minnesota Mining & Mfg. Co. Plant is located in St. Paul, Minn., and is an outgrowth of early Gustin-Bacon developments plus 3M developments. Precise beginning date for this company's work has not been ascertained.

Amercoat Corp., *Bondstrand*, developed by Amercoat and Young Development Corp. The plant is located in South Gate, Calif. Work is thought to have started in 1952.

A fifth company, the A. O. Smith Corp., located in Milwaukee, Wis., manufactures reinforced plastic dip tubes for hot water heaters in considerable quantity for its own captive market.

Other companies are known to be in development, such as Food Machinery & Chemical Corp., The Young Development Corp., and The Plastics Laboratory. Many others have been in the field from time to time, but their status is unknown at present. There are also specialists who make reinforced plastic electrical tubing on a custom or standard basis, generally in 10-ft. lengths or less. Such products are un-

tested for piping applications, but many have been available since the 1920's in some form of reinforced plastic tubular goods.

Three production techniques

There are basically only three methods for producing RP pipe. In the first, resin-impregnated fibrous glass is wound on a mandrel, forming the pipe up from the inside diameter. The second method, centrifugal casting, is to form the pipe inside a mold, building the glass and resin down from the mold which forms the pipe outside diameter. The third basic tooling includes mandrels and molds to form both the

High working pressures and service temperatures, light weight, and corrosion resistance of RP pipe bring substantial savings in many applications. Sales may reach annual rate of 5 million lineal ft. by 1960

pipe progress

By H. D. Boggs

Table I: Methods of producing reinforced plastics pipe

Production details	*Mandrel wrap*	*Centrifugal casting*	*Cavity molding*
Basic tooling	Inside mold or mandrel which forms the pipe I. D.	Outside mold which forms the pipe O. D.	Inside-outside molding tools—metal-endless belts—or pressure bags with metal
Methods	Winding	Centrifugal casting	1. Extruding —I. D. —O. D. molds 2. Pressure molding —I. D. —O. D. molds 3. I. D. or O. D. pressure bags with molds 4. Endless belt to form I. D. and O. D.
Glass forms used	Single ends Roving Woven cloth Woven tape Parallel fiber tape	Braided sleeve Woven cloth Fiber mat Woven tape	Single ends Roving Woven tape Braided sleeve
Method of resin application	Liquid as glass is applied, "B" staged, or prior to winding	Liquid injected into a spinning mold. Centrifugally distributed and degassed	Liquid as the glass is applied
Curing	Autoclave in separate location	In the mold under close control and split timing thru automation	"B" staged or completed in the machine. If "B" staged it is completed in an autoclave.
Commercial producers	Spiral-Glas Pipe Co. New Brunswick, N.J. Tower machine-mechanized Minnesota Mining & Mfg. Co., St. Paul, Minn. Horizontal machine Amercoat Corp. South Gate, Calif. Horizontal machine	Fibercast Co., a Div. of The Youngstown Sheet and Tube Co., Sand Springs, Okla. Conveyorized lines 100 by 255 ft., 12 automated casting machines	Experimental, specialty tube, fishing rods

Boggs

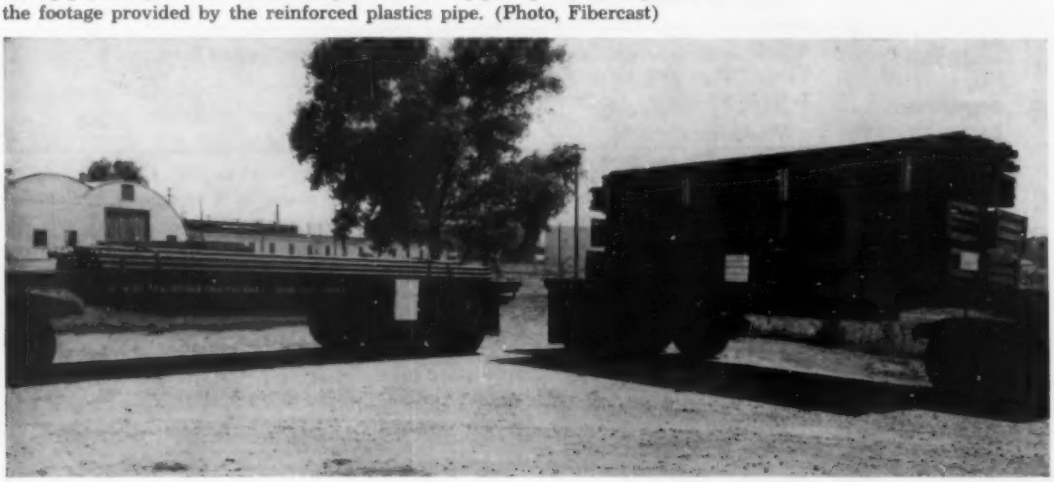
The author: General manager of Fibercast Co., Sand Springs, Okla., Mr. Boggs is also aeronautical engineer at Columbia Tech. and has attended Millikin University for business courses. He was previously affiliated with The Martin Co., Baltimore, Md., where he stayed for eight years and where his last position was assistant to the Vice-President and General Manager. Earlier service included two years as Production Manager of Goslin-Birmingham Mfg. Co. Mr. Boggs is president of H. D. Boggs Co., Ltd., owners of patents pertaining to centrifugally cast reinforced plastic pipe, and has been engaged in reinforced plastic products and processes development since 1947. Societies in which he is a member include S.P.I., S.P.E., A.S.T.M., A.P.I., and Rotary.

pipe I. D. and O. D. at the same time (see Table I, p. 97, for details). At present the mandrel wrap and centrifugal casting systems are being used to produce commercial pipe. Glass is generally braid, cloth, or wound fibers; principal resin is epoxy, but some polyesters are also used.

Basic problems of RP pipe

The most critical problem is to produce reinforced plastics pipe walls which are non-porous. The second fundamental problem centers around very thin "theory" pipe. The high cost of the raw materials tends to lead the engineer toward theoretically feasible high-strength and thin-walled pipe. But if history is to be a guide, industrial equipment based on thin designs seldom succeeds for the same reason that a two-ply auto tire would be a miserable headache though theoretically sound. Often rhythmic pulses add to pipe stresses from pumps. Severe heat cycling is also not uncommon. Other structural stresses, aside from fluid pressure, are common and frequently high in level. In essence no two pipe installations are subjected to the same environment and unfortunately many such environments are not reproducible in the lab. This suggests some of the reasons that "theory designs" suffer operating problems despite the attractive cost position it may represent. Whether we like it or not a certain degree of "Hell for Stout" design is a necessity to allow for all sorts of contingencies. A third problem is the fact that the industry is having a hard time making up its mind whether it is producing pipe or hose. The choice is important to the system of joining the lengths. Pipe is connected on the outside diameter. Hose, on the other hand, is connected on the inside and tends toward an I. D. standard size. This system is excellent with a flexible material, but it makes for complications when used with a rigid material such as reinforced plastics. A fourth problem is posed by the limited availability of couplings, turns, and special fittings. For example, the chemical industry uses about 25 or 30 basic

Same weight of well tubing has been loaded on each truck. At left is 3-in. steel pipe, at right 3-in. reinforced plastics. Steel pipe represents only 23% of the footage provided by the reinforced plastics pipe. (Photo, Fibercast)



fittings, all of which have countless variations. The use of a fitting for every five feet of pipe is not uncommon. On the other hand, the "oil patch" may use a fitting for an average of one every 16 to 18 ft. of pipe.

The pipe manufacturers are making many of the fittings available today but the range is not complete; and there is only one specialty manufacturer with an important and substantial reinforced plastic fittings line, Ed Conley Plastic Corp., Tulsa, Okla. Like pipe manufacturing, fittings require continual development, adding to tooling, improving process methods—all of which require substantial capital.

And finally, there is the problem of developing engineering data, standards, and every day working knowledge.

Advantages of RP pipe

Corrosion resistance which enables the pipe to handle hot acids, alkalies, salt waters, and corrosive gases is its outstanding advantage. Operating temperatures range through 300° F. and may go higher. Good dielectric properties eliminate electrolysis and electrolytic action.

High strength and dimensional stability are also important. Long term operating stresses upwards to 12,000 p.s.i. are practical. This is more than 20 times the strength of thermoplastics pipe throughout a greater range of temperatures. Moreover, this operating strength compares favorably with cast iron and some steels.

The weight of reinforced plastics pipe is one-

Flanged joint of a reinforced plastics pipe. Pipe was produced by mandrel-wrap technique. (Photo, Amercoat Corp.)

Table II: Commercial applications of reinforced plastics pipe

Oil and gas industry
Salt-water disposal wells
a) "Balanced column"—open end
b) "Packer method"—retrievable or non-retrievable
Combination injection—disposal wells
Pumping wells—530 to 2000 ft., with anchor
Mud anchors—bottom joints on steel tubing, below pump
Gas aeration wells—for water supply wells
Electrical pump supply wells—to supply injection water for water floods
Gathering lines of all descriptions, headers, etc.
Surface lines where paraffinic action is severe to steel
Tank battery hook-ups, complete prefabricated systems
Water "knock-out" towers, heat exchangers, heater-treaters
Gas-transmission lines
Electrolytic insulators
"Shot-hole" casing for exploration crews
Antennas for sound and recording trucks
Acid lines for workover operations
Tank floats for control valves
Liquid petroleum gas (LPG)
Road-crossing conduit
Oil well full-diameter core storage or shipping case
Injection lines on both input and output sides of pump

Chemical industry
Chemical disposal wells
In-plant piping for transporting numerous reagents, acids and alkalies
Slurry lines to resist mechanical abrasion
Overhead lines, where other materials necessitated continuous support
Plant lines, where insulation was necessary to prevent condensation
Plant lines, where external corrosion was a problem
Agitators for dump pits
Sparger tubes for steam-heating fluid tanks
Plant lines where plugging or steaming was necessary to remove buildup
Sulfur recovery tubing
Tubing for salt mining
Food processing
Sewage disposal
Handling airborne powders and grains
Industrial waste disposal
Fume venting
Pulp and paper digester liquids
Deionized waters

Miscellaneous installations
Electro stabilizers
Electrical fuse bodies
Insulators for transformer handles
Map cases
Vacuum chambers
Pickling acid lines in steel plants
Cooling tower piping
Structural tubing where light weight is required
Tanker piping, savings in dead weight of piping
Mine waste water
Refrigerant piping
Shipboard fire and atomic wash-down piping
Electrical conduit
Static discharge equipment
Rollers in process solutions

Table III: Producers of reinforced plastics pipe

Designation	Size in.	Wall in.	Max. operating conditions p.s.i.	Max. operating conditions °F.	Maximum temp. °F.	Process	General resin/glass description	Available method of joining	Available fittings
Amercoat Corp., South Gate, Calif.									
Bondstrand	2.375 O. D.	0.094	550	130	—	Mandrel wrap	Fibrous glass-reinforced epoxy pipe, glass resin ratio 80/20.	Flange wedge coupling victaulic thread	Tees Elbows
"	4.500 O. D.	0.125	500	130	—				
"	6.625 O. D.	0.172	445	130	—				
Fibercast Co., a Div. of The Youngstown Sheet and Tube Co., Sand Springs, Okla.									
	(O. D.)		(Recommended)			Automated centrifugal casting	H, L, N grades Modified Epon (Shell) and Z E, G, J grades Epon and Z TPE, TE tubing Epon and Z 2⅜, 2⅞, 3½ in. multiple layers of 58° braid and layers of axial fibers. 4½ in. special designed woven cloth. All glass is controlled heat treated.	*Line pipe* Threaded and coupled AST threads. Cement joints Flanged 150# Flanged 600# Adapters to I.P. and EUE threads Groove type and Dresser connections *Tubing* Threaded and coupled AST threads. Cross overs to EUE where required.	Threaded, cemented & flanged 150# and 600# tees, ells (90°—45°) Adapters Pipe Plugs Couplings I.P. couplings Cross overs Saddles Reducers in flanges, couplings and nipples Close nipples Wrench rings Blind flanges Wrenches Cement Thread lube Gaskets 260 types of fittings and sizes
H-500	2⅜	0.14	500	120	200				
E-300			200	260	300				
L-800	2⅜		800	120	200				
G-450		0.19	450	260	300				
N-1000			1000	120	200				
J-700	2⅜	0.24	700	260	300				
TPE-150		0.19	150 Collapse at 135° F.		Well				
TE-700	2⅜	0.28	700 Collapse at 135° F.		Tubing				
H-450	2⅞		450	120	200				
E-250		0.14	250	260	300				
N-1000			1000	120	200				
J-600	2⅞	0.24	600	260	300				
TPE-80		0.16	80 Collapse at 135° F.		Well				
TE-500	2⅞	0.26	500 Collapse at 135° F.		Tubing				
H-350			350	120	200				
E-200	3½	0.14	200	260	300				
L-600			600	120	200				
G-300	3½	0.19	300	260	300				
N-1000			1000	120	200				
J-500	3½	0.24	500	260	300				
TPE-150		0.19	100 Collapse at 135° F.		Well				
TE-350	3½	0.28	350 Collapse at 135° F.		Tubing				
H-250			250	120	200				
E-200	4½	0.16	200	260	300				
L-450			450	120	200				
G-300	4½	0.21	300	260	300				
N-800			800	120	200				
J-400	4½	0.26	400	260	300				
TPE-100		0.21	100 Collapse at 135° F.		Well				
TE-250	4½	0.30	250 Collapse at 135° F.		Tubing				
Minnesota Mining & Mfg. Co., St. Paul, Minn.									
3M Brand 2500C	2.067 I. D. 2.320 O.D.	0.125	800	150	150	Mandrel winding	Epoxy-glass filament	Threaded and coupled	Collars; other fittings in development
3M Brand 2600C	2.067 I. D. 2.60 O. D.	0.145	1200	150	150	Mandrel winding	Epoxy-glass filament	Threaded and coupled	Collars; other fittings in development
Spiral-Glas Pipe Co., New Brunswick, N. J.		(weight) lb./ft.							
Spiral-Glas standard	2	0.66	500	200	200	Continuous vertical lamination	Fibrous glass roving and DAP polyester between two mechanically bonded layers of Polyvinyl chloride	Split flange system, all diameters EUE 8 rd. threads up to 4 inches.	90° Elbows 45° Elbows Tees Bellows
	3	1.19	"	"	"				
	4	2	"	"	"				
	5	2.78	"	"	"				
	6	4	"	"	"				
Spiral-Glas extra heavy	2	0.90	1500	"	"				
	3	1.62	"	"	"				
	4	2.73	"	"	"				
	5	3.79	"	"	"				
	6	5.45	"	"	"				

fourth to one-fifth that of steel, and about two-thirds that of aluminum. Light weight is indirectly and directly important, especially as pipe becomes larger; for lower cost of fabrication goes hand in hand with light weight. The labor cost to erect metal pipe increases daily; reinforced plastics pipe does not require the use of heavy lifting and welding equipment.

The direct savings of weight in certain transportation structures is also economically important. It has been calculated, for instance, that 60 tons of dead weight could be removed from a ship tanker by using reinforced plastics pipe.

Reinforced plastics pipe resists chemical attack better than coated and protected metal pipe.

Smooth reinforced plastics pipe interiors remain smooth and often reject buildup from hard scale deposits, paraffin, etc. Hazen and Williams flow factors are also as high as C = 150. This means less pump and power or more gallons per minute for given pumps and power.

Reinforced plastics are low density materials, hence heat transfer is slow. Heavier pipe is better than thin pipe in this characteristic, which is important to chemical processing.

Iron or metal oxide traces, costly to many processes and products, are avoided by reinforced plastics pipe.

These advantages result in substantial economic gains despite a higher cost of reinforced plastics pipe compared to common steels in specific applications. And reinforced plastics pipe is substantially lower in first cost than many special metals.

Fields of application for RP pipe are listed in Table II, p. 99.

Marketing of commercial pipe began in 1952. It is estimated that for 1958, sales may be approaching 1½ to 2 million ft., with a product value of $3 to $4 million. Yearly rate of growth has been between 200 to 400 percent. A list of pipe manufacturers and types of pipe produced by them is shown in Table III, opposite page.

Capacities which exist today are expected to reach a straining point by 1960. The conveyorized operation at Fibercast alone is capable of more than one million ft. a year production capacity, and more is expected to be added in larger sizes. Spiral-Glas Co. capacity is also large. The others are unknown. If 1960 projections are correct, a 3 to 5 million-ft. output and sales per year is possible in sizes of 2 through 12 in., with a product value (including fittings) of $8 to $15 million.

Despite earlier problems, pipe made in 1952 and 1953 is still serving in applications where two days to 14 months was as long as the replaced pipe lasted. Epoxy pipe introduced in 1954 has shown a remarkable low of 0.01% problem history in the face of very tough corrosion applications in the chemical and oil industries as recently reported in detail to the National Association of Corrosion Engineers. Most of the field problems are related to connection and mechanical problems. Thin pipe has also shared some of the problem history.

What is the future?

The service history, the advantages, and the widespread piping of reagents, salts, and corrosive solutions point toward a market of impressive size. While an excess production capacity exists today, capturing (*To page* 189)

Reinforced plastics pipe being installed as part of a high-pressure salt water injection line. Light weight facilitates handling. (Photo, Minnesota Mining & Mfg. Co.)

Motored musical toys

With concentration on higher-priced quality merchandise, line is built on engineering for value through extensive use of plastics

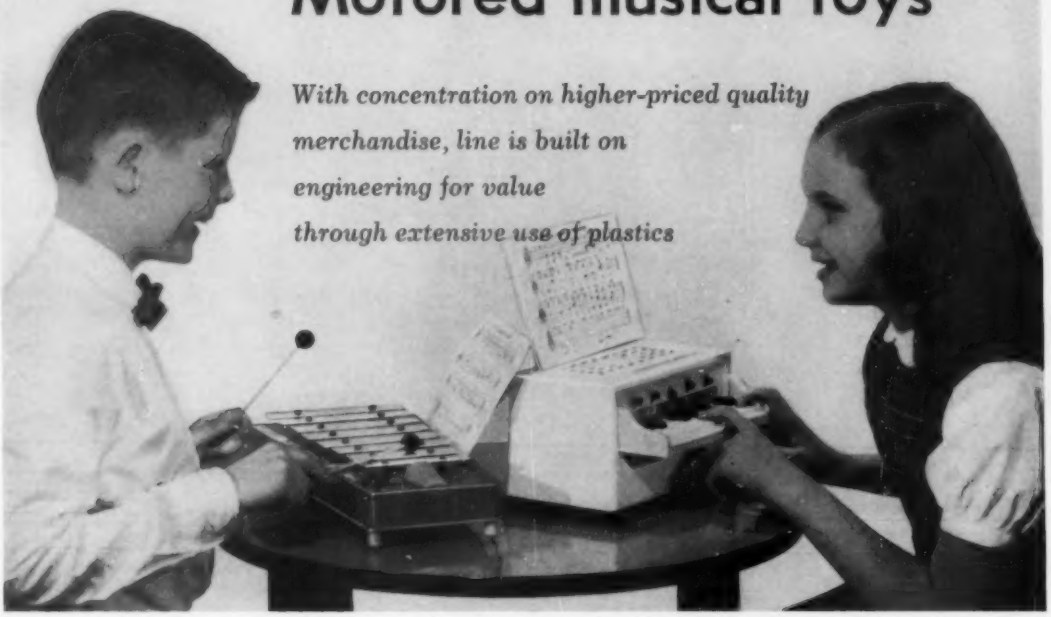


Fig. 1: Composed largely of molded styrene alloy and other plastics parts, Electronic Bell Organ (right) and Vibraphone (left) are aimed at high-quality market. Both are powered by dry-cell-operated motors

The new strategy of many U. S. toy makers is to leave the field of cheap, marginal-value toys to imports, and to build sales-dollar volume on higher-priced, quality merchandise. One company that has been outstandingly successful in this maneuver is Knickerbocker Plastic Co., Inc., N. Hollywood, Calif. This company, which once built its sales record on 29¢ water pistols, has just had its biggest season—in plastic musical toys that list for $10 and higher.

Two of these toys, a bell organ and a vibraphone (Fig. 1, above), both powered by dry cells, are among the most publicized toys (60 of the bell organs on a Perry Como show, for example) and are partly responsible for a 30% increase in sales over the previous year.

Engineered for value

The company has two rules: 1) use plastics whenever and wherever possible and 2) engineer the product for value. Although the organ and vibraphone are different in design and concept, these two rules were followed in both.

The Electronic Bell Organ has an eight-note keyboard; like all Knickerbocker musical instruments, it is keyed to the accompanying sheet music by color-code, numbers, and the usual note scale. (See A, Fig. 2, p. 103.) Depression of an individual key results in a tinkling, bell-like note that continues as long as the key is held down; a staccato depression of the key results in a single bell-like note. This permits the playing of the melody as well as sustained chords.

The resonator for each note (B in Fig. 2) is an extruded strip of special aluminum alloy developed for Knickerbocker by Aluminum Co. of America. Below the bar is a tuned fibre tube which acts as a resonant chamber (C in Fig. 2).

Normal procedure in toy instruments of this type is to have individual keys activate strikers that hit stationary sounding bars. In this case, however, a sounding bar and resonant chamber are an integral part of each key (D in Fig. 2). Depression of the key raises the sounding bar by simple pivot action, bringing it within range of a rotating striking mechanism (E in Fig. 2). As long as the key is depressed, the bar is within range of the rotating striker.

Instead of the striker hitting the bar, which would soon wear out the striker and the resonant bar, the striker just "kisses" the bar. At the same time, the striking rate remains constant to maintain tonal quality.

In the original model of the organ, the "kiss" problem of the striker was solved by mounting a revolving steel shaft directly over the eight resonant bars. On this shaft were eight steel

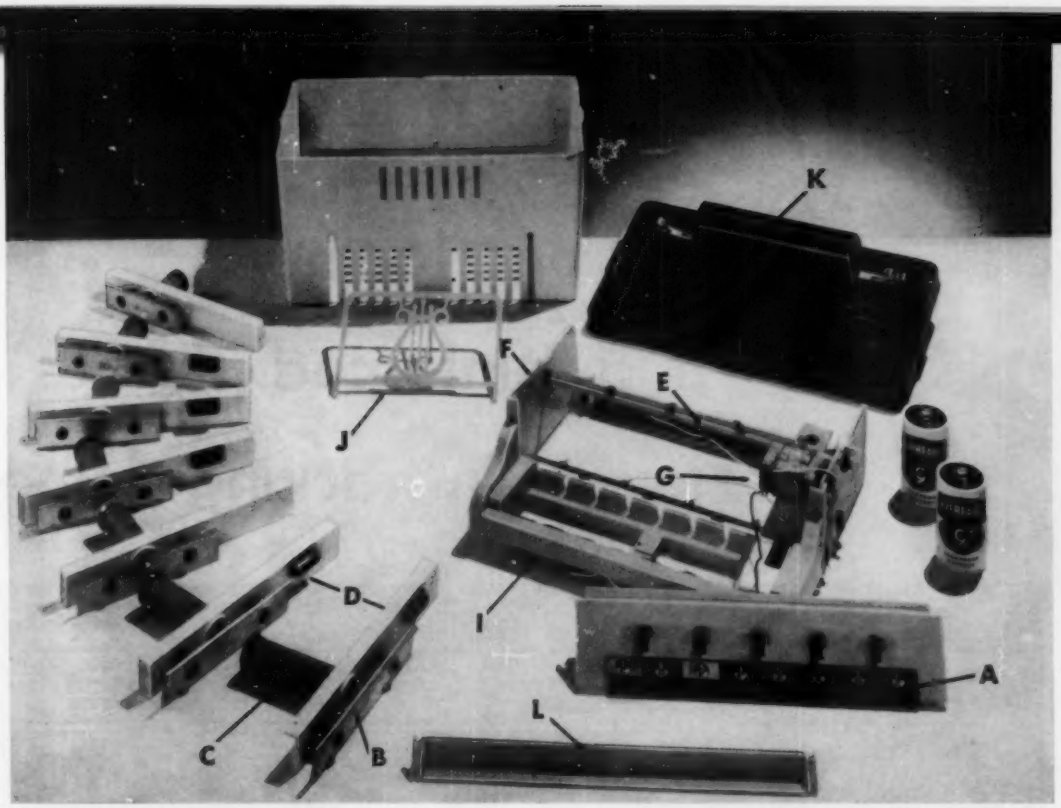


Fig. 2: Components of Electronic Bell Organ: A—Playing guide with color-code, numbers, note scale; B—resonator; C—resonant chamber; D—keys; E—striking mechanism; F—eyelet on which striking shaft runs; G—motor; H—case; I—frame; J—music rack; K—base; L—trim strip

loops; hanging on these loops were steel "percussive rings." When the shaft revolved, the percussive rings flew to the ends of the loops and "floated" there. When the resonant bar was brought within range by depression of an individual key, the percussive ring struck it.

This striking mechanism was re-engineered for injection molding, using Barrett's 8200 fibrous glass-filled nylon 6. The steel shaft, the loops, and two pulleys were replaced by a single molded piece (*To page* 188)

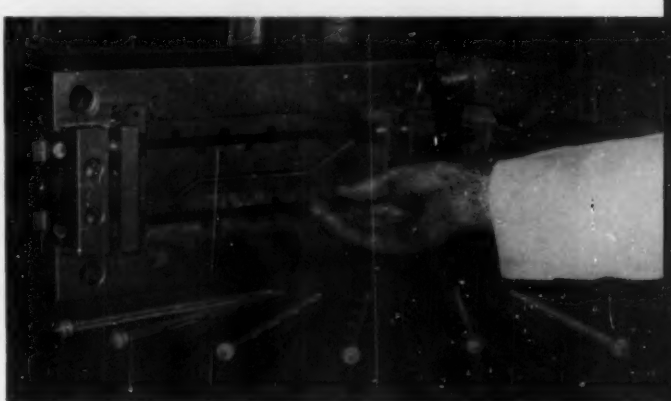
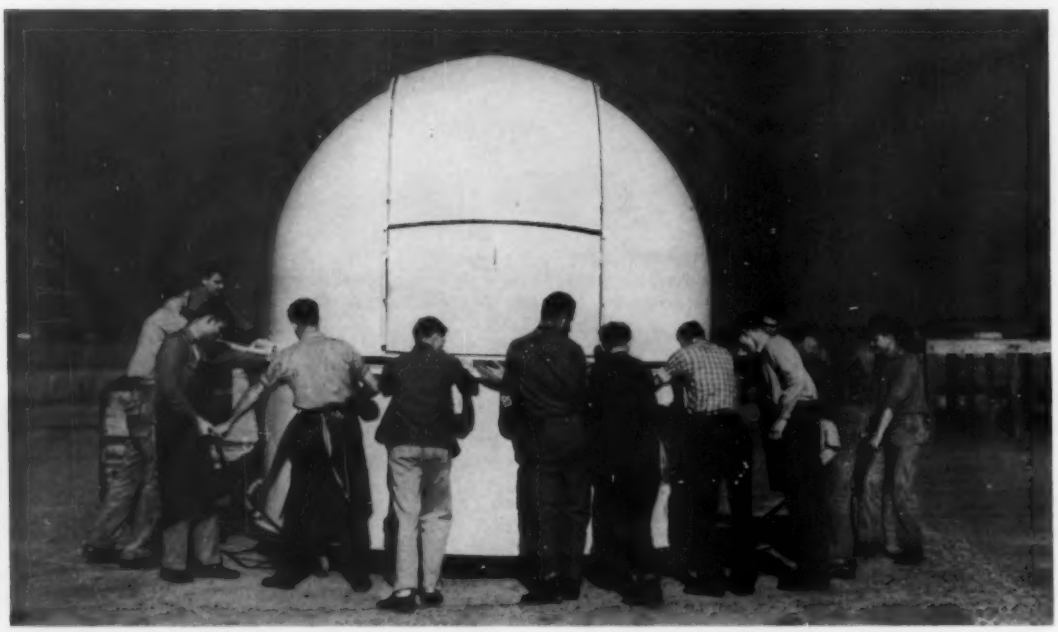


Fig. 3: Shaft of striking mechanism is injection molded of glass-filled nylon on a 3-oz. machine, using two-piece, two-cavity mold

Fig. 4: View of underside of Vibraphone base, with motor (right center), music rack, (lower right), and molded polyethylene legs (left). Inset shows detail of molded-in resonant chambers and polyethylene flutter valves

Styrene foam and reinforced plastics joined in tracking dome



Completed housing unit for synchronous tracking station is rolled out of manufacturer's plant for transportation to missile test range. Dome-shaped portion at top consists of styrene foam laminated between skins of fibrous glass-reinforced epoxy adhesive. For steps involved in production of dome, see photos on facing page. (Photos, Rubber & Asbestos Corp.)

Refrigerator manufacturers, boat builders, and other end user industries have long been stymied in their efforts to make sandwich structures of styrene foam cores and reinforced plastics skins. Reason was the use of polyester resin in the reinforced plastics faces: the styrene monomer in the polyester acts to dissolve and collapse the foamed polystyrene.

Now a new development suggests a fresh approach to this problem: replacing polyester with a room-temperature-curing epoxy-based adhesive. The adhesive doubles as a "casting" resin, saturating the fibrous glass reinforcement and at the same time bonding it to the styrene foam. While presently confined to the military and scientific field, the development bids fair to find consumer applications as well.

The case in point is the Astradome, a hemispheric housing of up to 16-ft. diameter, that protects high-speed cameras and other delicate instruments used to record test flights of missiles and aircraft and to track satellites. Such domes are part of synchronous tracking stations established at all missile test ranges in the United States and Canada. The structure consists essentially of 3-in.-thick blocks of Styrofoam foamed styrene sandwiched between skins of fibrous glass-reinforced epoxy. Cost of the adhesive is at least twice as much as that of polyester; however, because of production

Newly developed epoxy adhesive makes combination possible and also brings production economies

economies resulting from its use, the finished structure is reported to be considerably less expensive than those formerly made by the use of polyester-glass and a different type of insulation in the sandwich.

How the dome is built

A wooden frame serves as the mold. After it has been covered with release agent, pre-fabricated blocks of styrene foam, of approximately 2.2-lb./cu. ft. density and 3 in. thick, are positioned on the frame. A semi-thixotropic, 100% reactive, solvent-free modified epoxy adhesive—especially developed for this application—is brushed between and on top of the blocks. Tailored glass cloth is then laid up on the adhesive-coated foam. The adhesive performs three functions: it bonds the blocks of Styrofoam to each other, it bonds the glass cloth to the foam, and it partially impregnates the glass cloth. A second coat of adhesive is applied to the top surface of the glass cloth to complete the impregnation. The adhesive cures to a solid outer layer. At the end of the operation, the dome is lifted off the mold and the procedure repeated on the inside.

Sliding doors, which open for tracking purposes, are similarly constructed. The finished dome is painted white with an epoxy-based protective coating for improved insulation and visibility.

Properties formulated into the adhesive are claimed to include 1) easy "trowelability"; 2) degree of thixotropy that prevents curing in irregular bumps, which might necessitate subsequent sanding; 3) large per-gal. coverage—40 to 50 sq. ft. per gal. per coat; and 4) ability to withstand extremes of weather—humidity, heat, cold, and wind.

Credits: Manufactured by Alfred Hofmann & Co., Murfreesboro, Tenn.; Bondmaster M668 epoxy-based adhesive by Rubber & Asbestos Corp., Bloomfield, N. J.; Styrofoam by Dow.

Blocks of styrene foam are laid up on dome mold, which is covered with release paper. Structural strength is provided by steel framework. Blocks are coated with epoxy adhesive on all edges and back. Tape holds each block in position as assembly progresses

Coat of epoxy adhesive is spread on foam and layer of glass cloth laid in place. Adhesive penetrates for partial impregnation

Laid-up glass cloth is smoothed to avoid wrinkles in finished dome; second coat of adhesive completes impregnation

PLASTICS PRODUCTS

Vinyl bilge pump

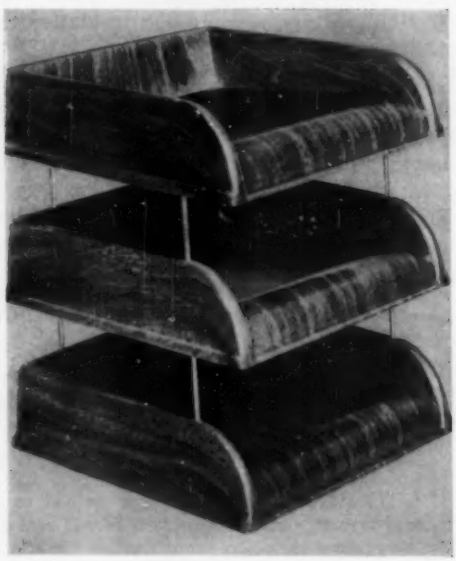
Small boat owners can now carry aboard a small, easily stored and inexpensive bilge pump made completely of vinyl. The main body of the pump is extruded of rigid vinyl, as is the hose for directing the flow of water out of the boat. The soft vinyl parts of the pump are injection molded. The pump, called the "Thirsty-mate," is available in sizes ranging from an 18 in. body ($4.95 with hose) to a 36 in. body ($10.95 with 3-ft. hose) which moves a gallon of water with less than three strokes.

Credits: Manufactured by Clark Metal Products, Inc., Box 3276-4 Barnum Sta., Bridgeport 5, Conn. Extrusions of B. F. Goodrich Geon vinyl by Jessall Plastics, Kensington, Conn.

Formed letter trays

Lightweight yet tough enough to withstand the rigors of daily office use, desk letter trays are vacuum formed from 80-mil rubber-modified styrene sheet in a range of integral woodgrain finishes to match modern office decor. The trays, 11½ in. wide by 12½ in. long, have holes drilled through the sides to permit tiering in multiple units, using standard stacking rods, or attachment of spring paper holder. Price is $3 per tray. This compares with about $3 for a good steel tray and roughly $2 for the wooden variety. But price is not the whole story. The vacuum formed unit will not dent, lose the color, splinter, or loosen at the joints.

Credits: Marketed by Capitol Metal Products Co., 577 University Ave., St. Paul, Minn.; forming by Plastic Forming Industries, Inc., at the same address; sheet by Campco Div., Chicago Molded Products Corp., 2717 N. Normandy Ave., Chicago, Ill.



Banana boat

A colorful, disposable serving dish made of high-impact polystyrene is finding widespread use in soda fountains, drive-ins, and restaurants. Originally designed as a container for serving banana splits, the deep, boat-shaped dish is also being used to serve hamburgers with french fries, fish 'n chips, and other short-order snacks. The injection molded containers are available in red, yellow, and blue, and nest for convenient storage.

Credits: Molded by Guild Plastics, Inc., 160 Munroe St., Cambridge, Mass., of Dylene polystyrene supplied by the Koppers Co., Inc.

"Stone" facing

Reinforced plastics facing that looks like real stone but weighs only one-thirtieth as much can be nailed up outdoors or indoors where structural limitations make the installation of real stone impossible or impractical. The product is available in panels 48½ in. wide by 12½ in. high, each containing seven "stones" of different shapes. The panels are molded in dies cast from carefully selected specimens of fine quarried stone. The 4 sq. ft. panels weigh only 4 lb. each. After the pieces are nailed in place, the recessed areas between the molded stones within a panel are filled by extruding a thin layer of all-weather compound through a caulking gun. Because the panels are light and simple to apply, installation costs are low. Cost of the facing is only ⅓ that of stone.

Credits: Manufactured by Terox Corp. of America, 3550 Lombard Ave., Franklin Park, Ill., of Owens-Corning Fiberglas and Polylite polyester resin supplied by Reichhold Chemicals, Inc.

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Reinforced molding with acrylic sirup

By John A. Ross,† Brian Mead,† and John T. Rundquist†

A new all-acrylic laminating resin can be used to make such glass-reinforced products as corrugated sheet, flat decorative and structural sheet, and furniture and other complex shapes. Structures made with this new resin have excellent resistance to weathering; thus the product is particularly useful in applications requiring outdoor exposure.

Most of the equipment now used by the industry for molding polyester resins can be used with acrylic sirup for production of articles by the contact process, by press lamination with mat or preform, and by press molding of premix compositions. Certain important process and equipment modifications are necessary, however. The effects of process variables on quality and methods for controlling quality are discussed.

A new all-acrylic resin in sirup form has been developed for use in reinforced plastics. Products made from acrylic resins are well known for their weatherability and beauty. Therefore, the use of reinforced acrylic is particularly attractive where both decorative qualities and weatherability are desired.

In addition, resistance to damage by impact and abrasion should add to the utility of the new all-acrylic resin. Properties were discussed in detail in Ref. 1[1], but the chief properties of two glass-resin compositions are given in Table I, p. 110.

Proposed uses for acrylic sirup include most of today's laminating applications, especially those where improved resistance to weather, impact, and abrasion are needed. Some of these include billboard trim, patio roofs, truck trailer skylights, awnings, industrial glazing, bodies for the transportation industries, gas-pump exteriors, outdoor phone booths, etc.

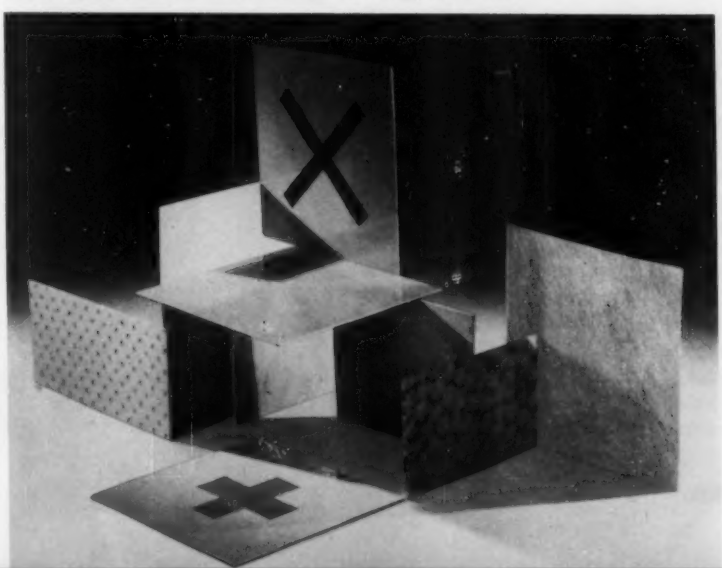
In this evaluation we have worked with Lucite acrylic sirup manufactured by Du Pont. The resin was supplied as a clear, water-white liquid at viscosities of 250 and 850 cp., compounded for low-pressure and press cures, respectively.

The work reported here demonstrates that this acrylic sirup can be processed with standard equipment and instruments of the type now used in the reinforced plastics industry.

Three molding techniques will be considered: contact-pressure, press lamination, and premix. A fourth method, that of postforming synthetic-fiber-reinforced acrylic sheet, has been described in Ref. 2.

Product lines represented by these fabricating techniques include corrugated sheet, flat dec-

Fig. 1: Samples of press-cured reinforced acrylic sheet show decorative possibilities of the material. (Photos, Du Pont)



*Reg. U. S. Pat. Off.

†Polychemicals Dept., E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

[1] See references at end of article.

Table I: Properties of reinforced panels made from acrylic sirup

Property	*A.S.T.M. test number*	*Values*	
Glass, % by weight	—	40	25
Method of fabrication	—	Press cure[1]	Contact cure[2]
Hardness, Rockwell "R,"	D785—51	125	121
Tensile strength, p.s.i., 23° C.	D638—56T	23,000	12,000
Elongation, %, 23° C.	D638—56T	1.7	1.5
Flexural strength, p.s.i., 23° C.	D790—49T	35,000	25,000
Flexural strength, p.s.i., 100° C.	D790—49T	14,000	8,000
Flexural strength, p.s.i., 23° C. wet[3]	D790—49	30,000	—
Flexural modulus, 10^6 p.s.i., 23° C.	D790—49T	1.6	0.9
Flexural modulus, 10^6 p.s.i., 100° C.	D790—49T	0.8	0.3
Compressive strength, p.s.i., 23° C.	D695—54	25,000	24,000
Izod impact, ft.-lb./in. of notch	D256—56	14	6
Taber abrasion[4]	—	30	33
Heat distortion temperature, 264 p.s.i., °F.	D648—56	256	233
Coefficient of linear thermal expansion	D696—44	4×10^{-5}	—
Flammability, in./min.	D635—56T	—	1.3
Dielectric constant, 1000 cycles	D150—54T	5.0	4.1
Dissipation factor, 1000 cycles	D150—54T	0.007	0.05
Light transmittance, total % (1/16 in.)	—	—	60-65
Diffuse transmittance, % of total	—	—	95-98

[1] Lucite 201 X.
[2] Lucite 202 X.
[3] Following 2-hr. boil.
[4] Weight loss, mg./1000 cycles. CS-17, 1000 g.

orative and structural sheet, and complex shapes. Typical products are illustrated in Fig. 1, p. 109, and Fig. 2, below.

All of these molding methods begin with impregnation of the fibrous reinforcement by liquid resin followed by a curing stage during which the resin hardens. They differ in the class of product produced and in the time, temperature, and pressure required for cure. For processing characteristics, see Table II p. 112.

Contact process

In the contact process the sirup-soaked composite of reinforcement and resin is sandwiched between sheets of cellophane or other film and heat-cured in contact with forming surfaces. Since the cellophane sheets are easily stripped from the cured laminate, no special release agents are required. A flow diagram of the process is sketched in Fig. 3, p. 111.

In our work we have cured the sheets in stacks of alternate wet lay-ups and aluminum caul plates, using a steam-heated, air-recirculating-type oven. Cure pressures in the range of 0.1 to 0.3 p.s.i. were obtained by weighting the stack.

Since the polymerization reaction during the cure is exothermic, excessive temperatures can build up during cure unless the oven temperature and air flow are under close control.

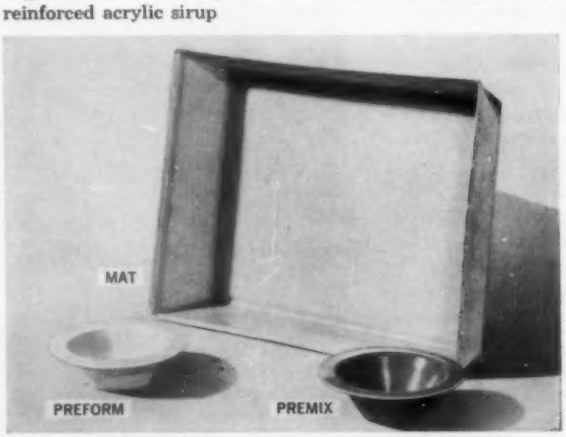
Figure 4, p. 111, shows a typical temperature-vs.-time plot for a sheet being cured in the middle of a stack. These temperatures were measured by inserting thermocouple junctions in the stack. Such couples provide good means of judging the course of the cure. Their use can be recommended in the development of optimum cycles for any similar cure system.

In the beginning of the cure cycle the oven must add sufficient heat to the stack to raise its temperature to the effective activation threshold for the initiator (benzoyl peroxide in this case). During this time (the first hour in Fig. 4) the temperature rises rather uniformly. With the initiator becoming active, and with the onset of the exothermic polymerization reaction, additional heat of polymerization is generated internally and the temperature rises sharply. This rise tends to accelerate the polymerization process as long as sufficient monomer is available. The steep rise occurs between 70 and 87 min. in Fig. 4. After 80 min. the stack temperature exceeds the oven air temperature and the oven then begins to cool the stack instead of heating it.

After most of the monomer is used up in polymerization, the rate of evolution of heat slows down. When it falls below the rate at which heat is removed by the cooling air flow, the temperature begins to drop. This maximum or peak in the temperature is called the exotherm peak.

Cure completion can be judged conveniently by the Barcol Impressor, a type of hardness gage. A reading of 50 or greater after 5 sec. delay indicates an adequate cure. Such a measurement is rec-

Fig. 2: Dishes and tray made in matched-metal molds from reinforced acrylic sirup



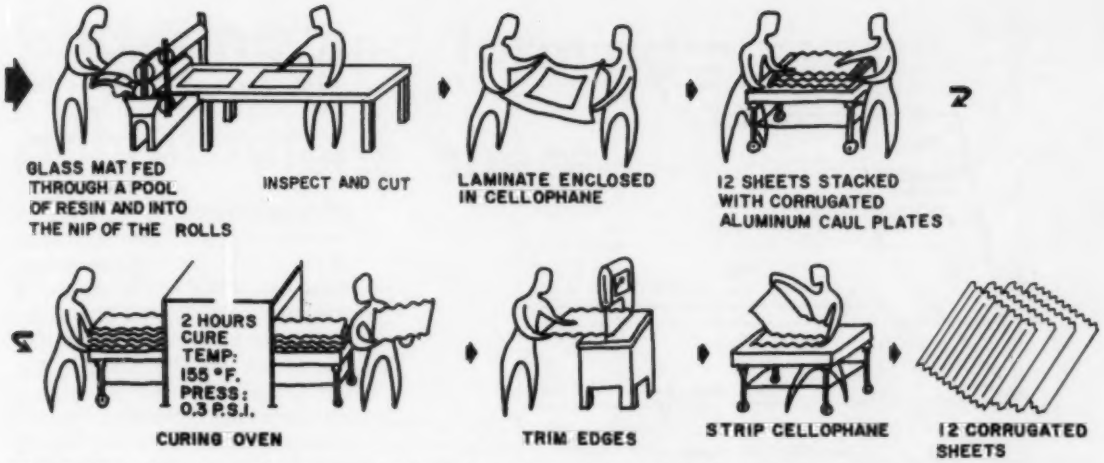


Fig. 3: Flow chart for making corrugated sheets from glass-reinforced acrylic sirup by contact process

ommended, otherwise an inadequate cure might go unnoticed until its effects appear later as a degradation of appearance.

Another criterion of quality is freedom from bubbles. Bubbles of course are immediately visible. They tend to form when the pressure of volatile material in the resin exceeds the sum of the external pressure and the viscous resistance of the resin. The danger point occurs when the vapor pressure reaches the external pressure, and this is most likely to be at the exotherm-peak time. Since external pressures are low in the contact process, a high priority is placed on early increase in viscosity and/or reduction of vapor pressure by removal of dissolved gases.

The two major gas sources normally present are monomer and dissolved air. The monomer is an essential part of the sirup and is "removed" by polymerization during cure, while air can be removed by degassing prior to impregnation. A degassing step is necessary to obtain a bubble-free product at low cure-pressure. Care must be taken to avoid subsequent excessive aeration during impregnation. We have had no trouble in this respect with the machine-type impregnators which are rapidly gaining acceptance.

Viscosity, a factor in preventing bubble formation, is influenced by the type and concentration of initiator, and by combined effects of time and temperature during cure.

It should be noted that while the danger of bubbling passes with the exotherm peak, the piece is not necessarily fully cured then, and additional cure time might be required.

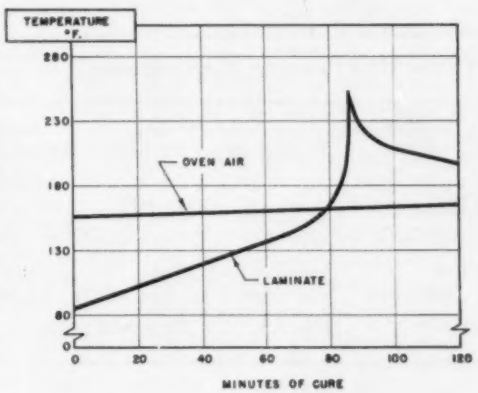


Fig. 4: Temperature of oven air and center of laminate during cure of corrugated sheet. Sheet contained 25% glass, was 1/16 in. thick, was located in center of stack of six sheets separated by 1/16-in. aluminum cauls. Air velocity across stack was approximately 50 ft./min.

Press cure

Flat sheet can also be cured under pressure in a press using heated platens and a gasket. Figure 5, below, shows such a sheet being laid up. Three-dimensional shapes can be press molded in matched-metal molds. The close fit and positive nature of the edge seal developed in these molds allows the use of even higher pressures and consequently shorter cycles.

The equipment required for

Fig. 5: Operator lays up a glass-mat laminate on cellophane separating film, prior to pressing

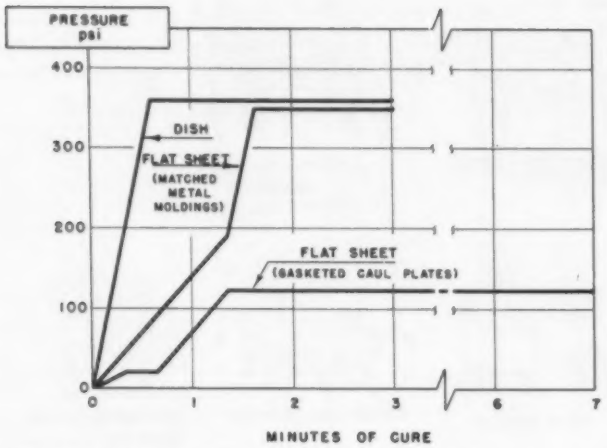


Fig. 6: Build-up of pressure during molding of reinforced acrylic pieces

Table II: Processing characteristics

Molding method	*Product line*	*Equipment*	*Cure temperature*	*Cure time*	*Curing pressure*
			°F.	min.	p.s.i.
Contact pressure	Corrugated sheet	Impregnators and cure oven	155	60 to 120	0.1 to 0.3
Press lamination	Moldings and Flat sheet	Press and molds	239 258	7 2 to 4	150 300 to 500
Premix	Moldings	Press and molds	258	1.5 to 3	to 1000

press molding acrylic sirup is exactly the same as that now in use for polyester moldings. The only operating difference is that a more gradual application of pressure is required early in the cycle. The exact pressure cycle depends upon the shape, thickness, reinforcement, etc. and must be determined for each new article. Three such pressure cycles, determined experimentally, are shown in Fig. 6, above. Cure time for flat sheet moldings between caul plates is in the range of 7 min. for a 1/16-in. thick sheet. For a matched-metal molding of 1/16-in. thickness, cure times as short as 2.5 min. have been obtained in our tests.

Sticking to the mold is a problem in the molding of acrylic sirups, particularly in molds which have previously been operated with other resins. Zinc stearate is the most effective of several release agents tested. It can be applied by wiping it on the mold between shots, or it may be mixed into the sirup at a concentration of about 2 percent. Some control of sticking can also be obtained through adjustment of the amount of filler in the resin mixture. It has been observed that filled parts tend to release first from the male mold; unfilled laminates usually release first from the female side.

The course of the polymerization during the cure cycle in matched-metal molds can be followed conveniently by the rate of advance of the ram. As the sirup polymerizes it increases in density with a volume shrinkage of about 17%, all in the thickness direction. (This figure applies to the pure sirup. Typical laminates, containing reinforcement and fillers, shrink less, depending on the percentage of inert materials.) The shrinkage is taken up by forward movement of the ram during cure.

If the travel of the ram is followed, the piece thickness can be plotted as a function of time during curing, as in Fig. 7, below. In the early stages of the cure, resin is still flowing laterally in the mate to equalize distribution, and this, too, is reflected in the ram travel. But later, the change in thickness is due primarily to shrinkage, and the rate of this change falls sharply as the cure approaches completion. This is indicated by the flattening of the curves of Fig. 7 as the laminate thickness approaches its final value of 90 mils. The curves also show, as would be expected, that rate of cure increases rapidly with temperature—about two-fold for a 10° C. temperature rise.

Like other thermosetting laminating resins, the acrylic press-molded laminates need not be cooled but have sufficient hot

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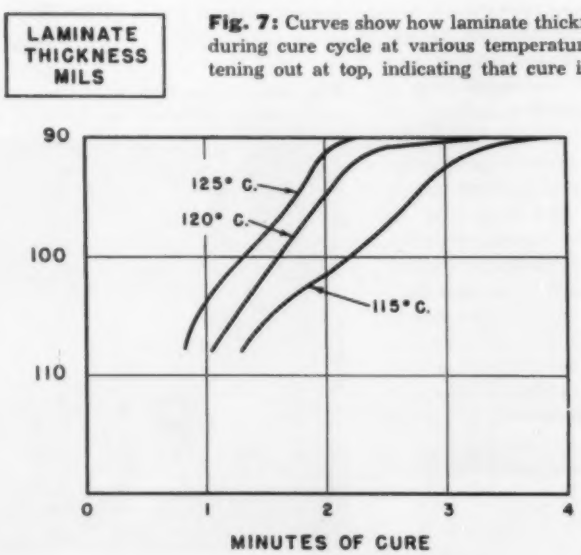


Fig. 7: Curves show how laminate thickness decreases during cure cycle at various temperatures. Note flattening out at top, indicating that cure is complete

Choosing and forming polyethylene sheet

*By A. G. Rowe**

The thermoforming properties of polyethylene, such as sag resistance and hot strength, are shown to be linked to the fundamental characteristics: melt index, density, and breadth of molecular-weight distribution. Heating and cooling rates at various sheet thicknesses have been investigated, and it was found that with a heater bank of about twice the usual watt density, polyethylene sheets can be heated rapidly and safely to forming temperatures.

The process for thermoforming thermoplastic sheet by mechanical and/or vacuum drawing has enjoyed rapid growth over the past five years. With this growth there has been increasing interest on the part of processors and end-users in the process for making products from polyethylene. Interest in polyethylene is based on the unique combination of properties offered by this material: e.g., extreme toughness over a wide range of temperatures, complete freedom from toxicity, and excellent resistance to chemical attack.

Despite this interest, new products and packages formed from polyethylene sheet have been slow in making their appearance on the market. A careful analysis of the reasons for this discloses no flaw in the belief that polyethylene, because of its end-use properties, has an excellent future in the sheet-forming field. The apparent slow growth in polyethylene forming can be explained in terms of the need for development effort in three areas.

First, a considerable degree of selectivity is required in picking end-uses where the unique properties of polyethylene are of most value. This selection having been made, an entirely new concept of product design is often involved and this means that a carefully planned and executed program of prototype testing is necessary. Such programs involve time. Thus, sound end-uses conceived today may not appear on the market for a year or more. End-use development work is frequently a cooperative effort on the part of end-user, processor, and resin supplier.

Second, processing characteristics of polyethylene are, to some extent, different from those of other forming resins in both the sheet-extrusion and the forming operation. To cite a simple example, vacuum ports in a mold designed for polyethylene will be much smaller than in a mold for polystyrene. Differences in heating and cooling are noted later.

Finally, the success of end-use and process development efforts will usually be dependent on use of a resin with the proper characteristics. Resins tailor-made for sheet-extrusion and forming have been commercially available for only a year. The need for tailor-made resins is underlined by the frequently unsatisfactory results of the earliest attempts at polyethylene thermoforming where resins designed for other uses were employed.

These early failures convinced

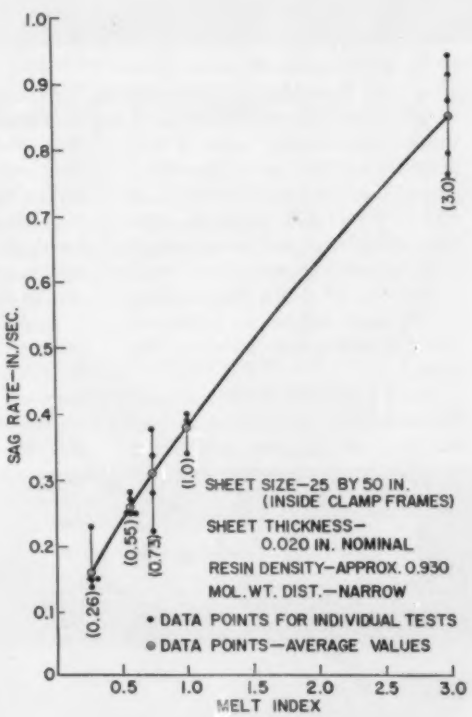


Fig. 1: Sag rate versus melt index for polyethylene resins of intermediate (0.930) density and narrow molecular weight distribution

*Sales Service Laboratory, Polychemicals Dept., E. I. du Pont de Nemours & Co., Wilmington, Del.

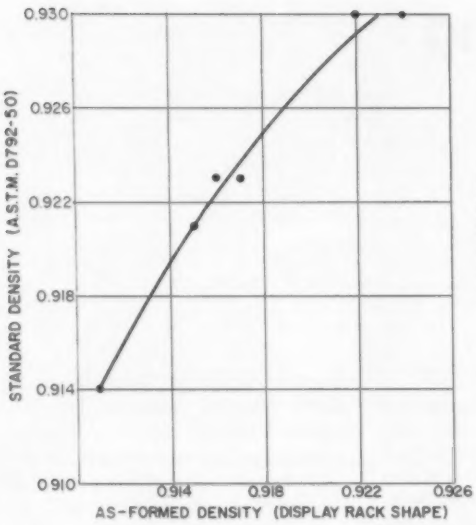


Fig. 2: Standard density of six polyethylene resins versus as-formed density for a given set of operating conditions

some processors that polyethylene was not only different from other resins, but that it was far more difficult, if not impossible, to form on a practical basis. Resin development is primarily the responsibility of resin suppliers. Much of the rest of this article deals with the characteristics required of a resin to make it suitable for sheet extrusion and thermoforming. This discussion is, in essence, a description of the development of Alathon 31[1] polyethylene resin.

Resin development

Three characteristics can be used to describe a polyethylene resin. These are melt index, density, and breadth of molecular weight distribution. Melt index is the familiar measurement of flow properties of the resin. Density, a measure of resin crystallinity, is also a direct indication of stiffness. Breadth of molecular weight distribution indicates the spread in weights of molecules making up the resin and has an important effect on end-use properties of the resin.

The search for optimum resin characteristics began with an extrusion and forming evaluation of a number of commercial resins, each having a different combination of characteristics. None of these resins was completely suitable; but taken together they covered essentially the whole range of values possible (from a commercial standpoint) for each characteristic. This was followed by evaluation of a series of experimental resins with characteristics which bracketed the values shown to be optimum in the first evaluation. Results of the second evaluation pinpointed the characteristics desired in a thermoforming resin. A discussion of the factors considered in selecting each characteristic is given in the following paragraphs.

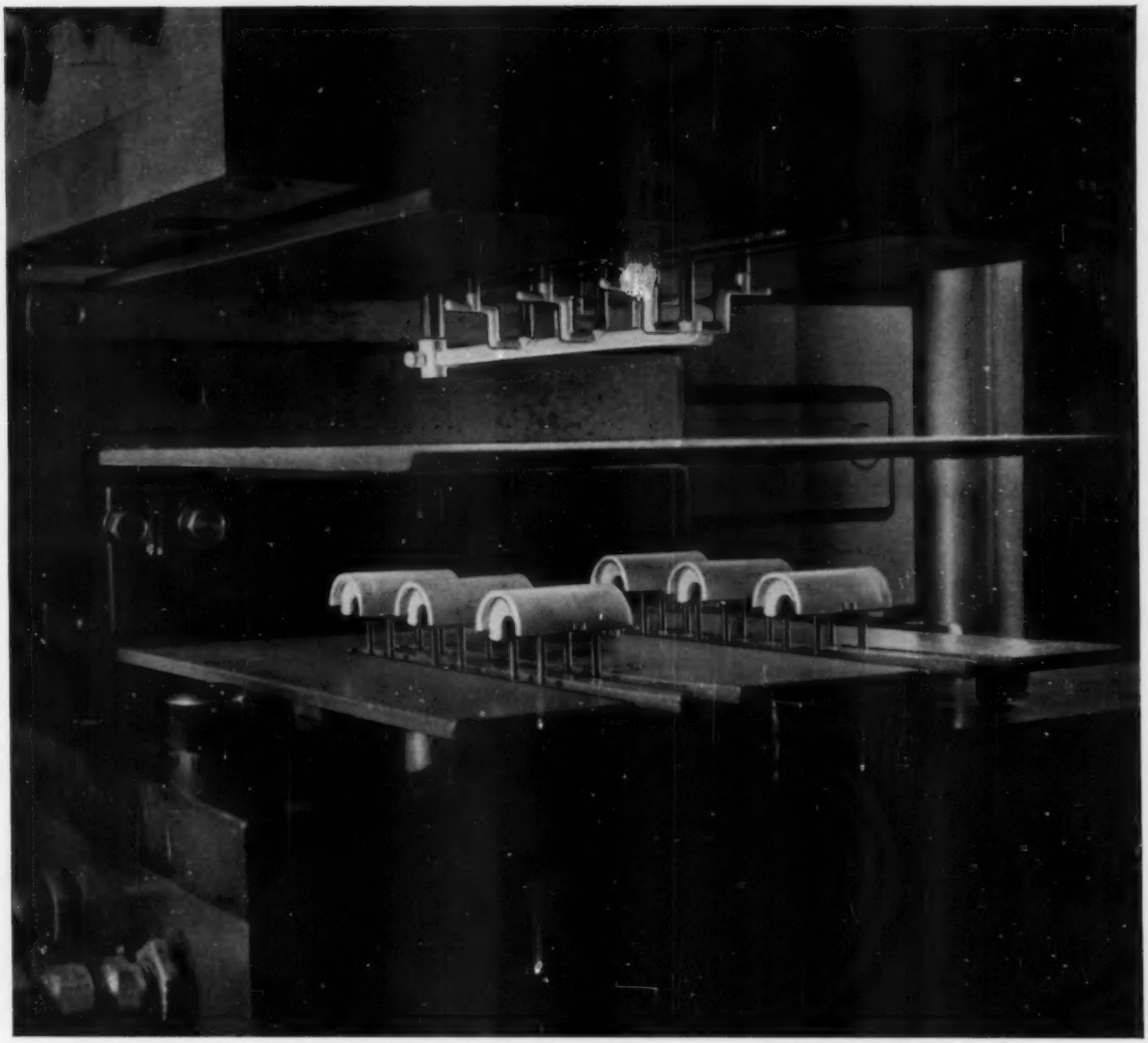
Melt index: In early attempts to form polyethylene, excessive sag in sheet heated to forming temperature was a common problem. Holding sag within tolerable limits is dependent on reducing the rate at which the sheet sags during the few seconds between the time the sheet passes through the crystalline melting point and the time it is brought into contact with the mold. As melt index is decreased, melt viscosity is increased and sag rate is reduced. The curve in Fig. 1, p. 113, shows the relationship between melt index and sag rate for resins of intermediate density (approx. 0.930 g./cc.) and narrow molecular weight distribution ($M_w/M_n<10$). The following procedure was used to determine the sag-rate data points for the curve: A 20-mil, 25- by 50-in. sheet of natural-color resin was placed in the clamping frames of a forming unit and the heater bank was brought forward over the sheet. The sheet was heated until its temperature was just above the crystalline melting point as evidenced by a marked increase in transparency of the sheet. At this point, the heater bank was withdrawn and sag at the center of sheet was measured. Approximately 10 sec. later, sag was again measured. The exact time interval between the sag readings was noted. Using the difference in sag reading and the elapsed time between readings, rate of sag for each sheet was calculated. For four of the five resins tested, the above test was repeated five times. Only three tests were made with the 1.0 melt index resin because of limited sheet supply. The data point for each individual test is plotted in Fig. 1, the curve being drawn through the average sag rate value for each melt index.

As indicated by Fig. 1, control of sag is one factor which favors low melt index. In addition, strength and toughness properties of the resin improve as melt index decreases. The extent to which melt index can be decreased is limited primarily by processing characteristics. If the melt index is too low, it becomes difficult to extrude sheet with glossy surfaces, to accurately reproduce detail in the forming mold, and, in some cases, to form deeply-drawn shapes without tearing the sheet.

Fortunately, a good compromise is possible between those factors favoring high and those favoring low melt index. At 0.55 melt index, polyethylene resin can be extruded to make glossy sheet which can be formed with no tendency to tear and has excellent strength and toughness properties. Sag rate at this melt index is low enough to be well within tolerable limits for most forming operations. Figure 1 shows that a 25- by 50-in. sheet exhibited a sag rate of less than 0.3 in./second.

Density: As density is increased, stiffness of the resin increases, resistance to elevated temperatures is improved, but toughness properties become poorer. For the range of densities available in branched polyethylene resins, the changes in temperature resistance and tough-

[1]Alathon is the registered trademark for Du Pont's polyethylene resins.



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ness are relatively small. For most thermoforming applications, the gain in stiffness is by far the most significant change in properties since stiffness required will determine thickness of sheet used. Thus, high resin density is desirable since required stiffness can be provided at a lower raw material cost.

In literature describing a resin, the accepted practice is to report standard density and stiffness values as determined by A.S.T.M. test methods D 792-50 and D 747-50. However, the conditions for preparing and annealing samples for the A.S.T.M. tests are not duplicated in any commercial processing technique. Stiffness and density of a resin in the as-formed condition will be lower than the standard values for the same resin as determined by the A.S.T.M. test methods. To illustrate this, Fig. 2, p. 114, shows standard density of six polyethylene resins plotted against the density of the same resins when formed into a display rack (Fig. 3, below. For each resin, the value plotted for as-formed density was the average of density readings taken at three points (back and each sidewall) on the display rack. Examination of Fig. 2 shows that a resin having a standard density of 0.930 and a corresponding standard stiffness of 40,000 p.s.i. would, for this case, have an as-formed density of about 0.923 with as-formed stiffness in the 25 to 30,000 p.s.i. range. It should be noted that Fig. 2 can only serve as an indication of the size of the difference between standard and as-formed densities. Values from the curve will not necessarily be correct where different sheet thicknesses, mold configurations, or operating conditions are used.

Linear polyethylene resins show excellent promise as the eventual answer to the "cost-of-stiffness" question. However, by comparison with current linear resins, tailor-made branched resin is more readily extruded into high-quality sheeting. Processing advantages of branched resin are even more apparent in the forming operation where good drawing characteristics are important. Experimental extrusion and forming runs show that tailor-made branched resin stability is such that the material is not degraded in the normal extrusion or forming operation. Trim material can be reprocessed to yield sheeting and formed products of good quality with little or no change in extrusion and forming conditions. The time needed to develop a linear resin with all of these desirable characteristics cannot be predicted accurately but, since the basic problem of controlling resin characteristics is involved, a year or more will probably be required.

Molecular weight distribution: Narrow molecular weight distribution is desirable primarily because it provides good end-use properties. As the breadth of molecular weight distribution is decreased, there is an increase in strength and toughness of the resin, an increase in softening temperature, and an increase in resistance to environmental stress-cracking. While low melt index was specified primarily on the basis of processing characteristics, it also results in improvement in most of the above properties. The net result of narrow distribution and low melt index is a resin with outstanding physical properties.

There is no significant change in processing characteristics over the range of molecular weight distribution which provides good physical properties.

To summarize, designing a polyethylene resin for sheet extrusion and thermoforming is largely a matter of balancing factors favoring high and low values for each characteristic. Processability is the dominant factor in selecting melt index while the values for density and molecular weight distribution are decided primarily on the basis of the particular properties that are desired by the user.

Processing characteristics

Heating: The need for extra heating is frequently cited as a difference between polyethylene and other forming resins. It is true that, with many heater banks, more heating time is required for polyethylene, largely because of its higher specific heat. However, with proper heater bank design, polyethylene sheet can be heated at satisfactorily high rates.

Factors which determine the time required to heat polyethylene sheet to forming temperature are as follows: heater density; heater rod temperature; sheet-to-heater-rod spacing; radiant energy absorption characteristics of the material; sheet thickness; and final sheet temperature required for forming.

Heating time is greatly affected by "heater density"—a convenient term for describing the ratio of electrical power input to the heater bank (kilowatts) to total area of the heater bank (square feet). The benefit of high heater

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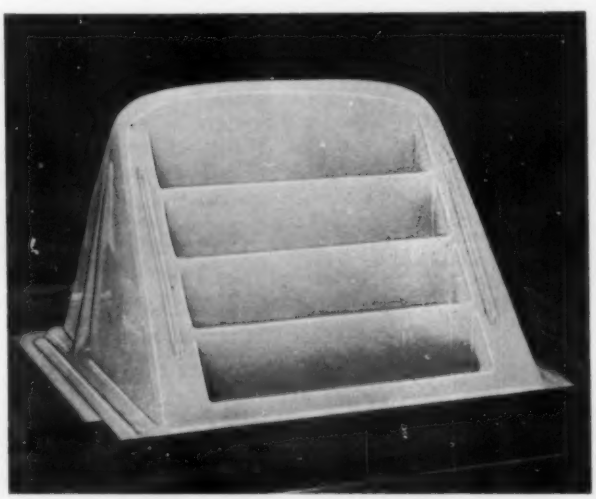

Fig. 3: Thermoformed display rack used in investigation of differences in original and as-formed densities

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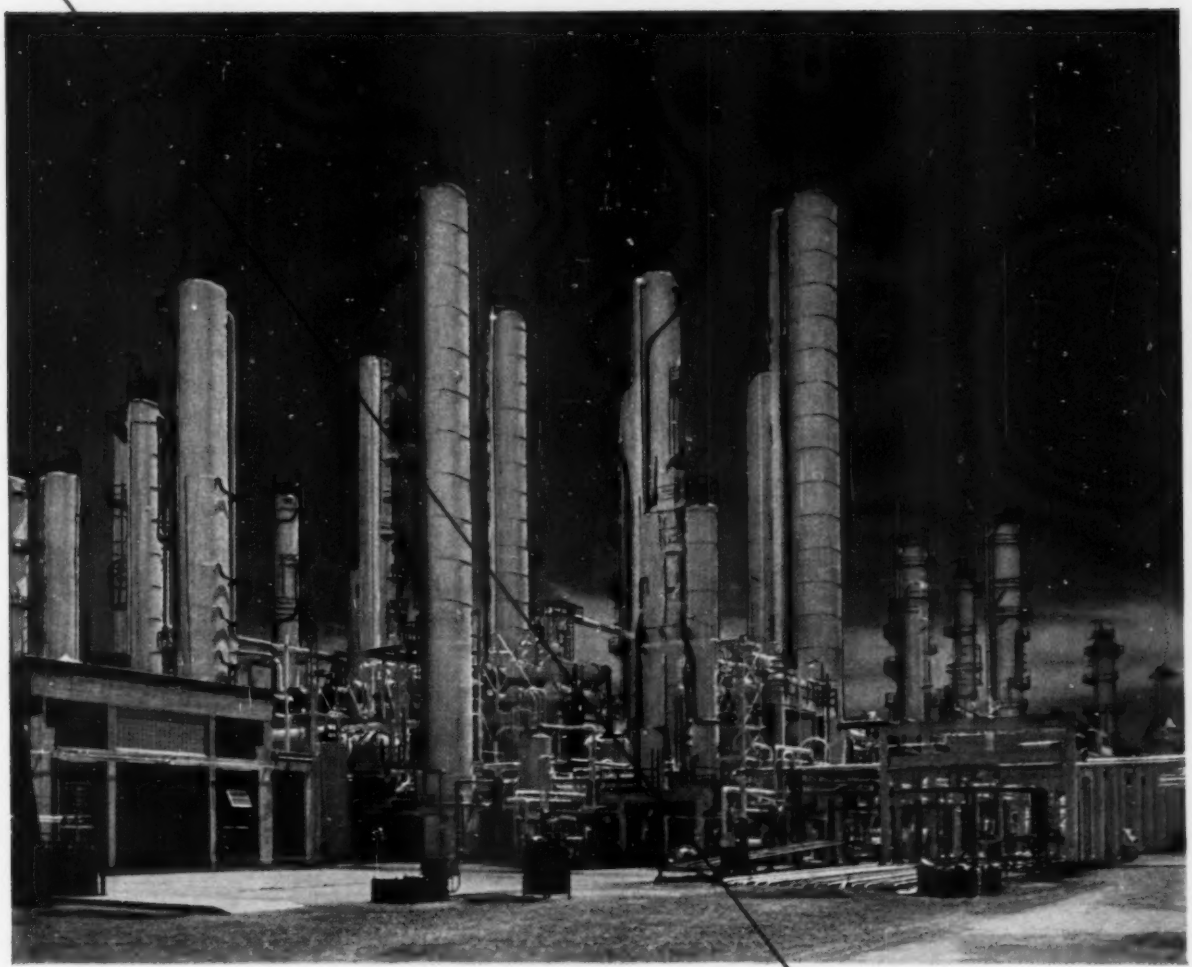

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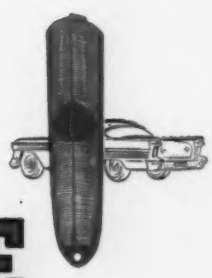

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density is illustrated by the two curves shown in Fig. 4, below. Data points for these curves were obtained as follows: A hole, 1/16 in. in diameter and 1½ in. deep was drilled into the edge of a 0.120-in.-thick sheet of polyethylene resin. A thermocouple was inserted into the drilled hole, the sheet was placed in the clamp frame of a forming unit, and the frame was rolled into the heating oven which was equipped with radiant heater banks above and below the sheet. Sheet temperature was read at 10-sec. intervals until it reached approximately 350° F. This is above the highest temperature normally used in forming. This procedure was repeated five times with sheet heated from both sides, then five times with sheet heated by the upper heater bank only. For each curve in Fig. 4 points for all five runs are plotted to show the extent of variation in data. Curve "A" is the plot of sheet temperature vs. heating time with radiant heater banks above and below the sheet. These banks provided a heater density of 3.6 kw./sq. ft. Curve "B" is the plot for identical sheets heated with the upper heater bank only. In this case, heater density was reduced 50% to 1.8 kw./sq. ft. With the upper heater bank alone, 160 sec. of heating or about 1.3 sec. per mil of thickness were required to reach 250° F., the lower end of the forming temperature range. Doubling heater density by use of both heater banks reduced time for heating to the same temperature to 70 sec., or about 0.6 sec. per mil of thickness. This is near the highest heating rate which can be used for some of the other forming resins without danger of causing surface bubbles or blushing. Polyethylene showed no tendency to bubble or blush at the 3.6-kw./sq. ft. heater density. Limited experience with a 5.8-kw./sq. ft. heater bank indicates a heating time of 25 sec. for 0.080-in. sheet, or, about 1/3 sec. per mil of thickness. Again, no adverse effect from the rapid heating was noted. In short, the practical solution to the problem of rapidly heating polyethylene sheet involves a moderate investment in a high-density heater bank.

Table I: Minimum heating for various sheet thickness

Sheet thickness	*Heating time*	*Heating time per unit thickness*
in.	*sec.*	*sec./mil*
0.020	18	0.9
0.060	36	0.6
0.100	48	0.5

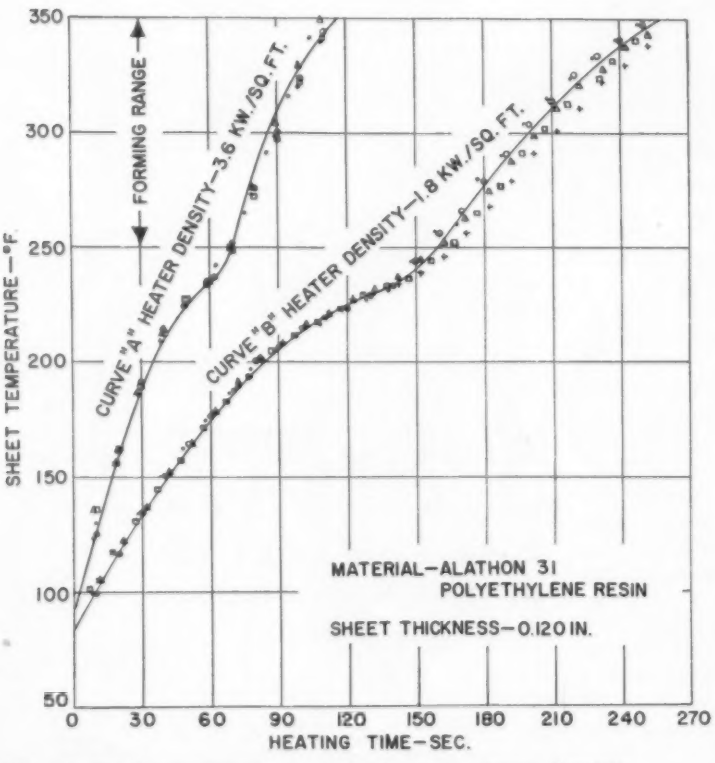

Fig. 4: Sheet temperature versus heating time. Curves illustrate benefits of high heater density. Curve *A*—heater banks above and below sheet; curve *B*—heater bank above sheet only

Fast heating

Operation at maximum heater-rod temperature to obtain fast heating is both effective and economically sound. It is true that, as heater temperature increases, a greater proportion of the energy emitted is in the short wavelengths which the sheet will not readily absorb. This means the electrical energy supplied to the heater bank is utilized less efficiently at maximum temperature than at a lower temperature. However, the total energy emitted is proportional to the fourth power of absolute temperature. As heater temperature increases, there is a big increase in energy emission at all wavelengths. The resultant gain in sheet heating rate outweighs by far the penalty in reduced heater efficiency.

The optimum sheet-to-heater-rod spacing is the minimum distance that can be used without producing a rod pattern on the heated sheet. Spacing is not critical except where the sheet being heated is nearly as large as the heater bank. In such a case, spacing should be close enough

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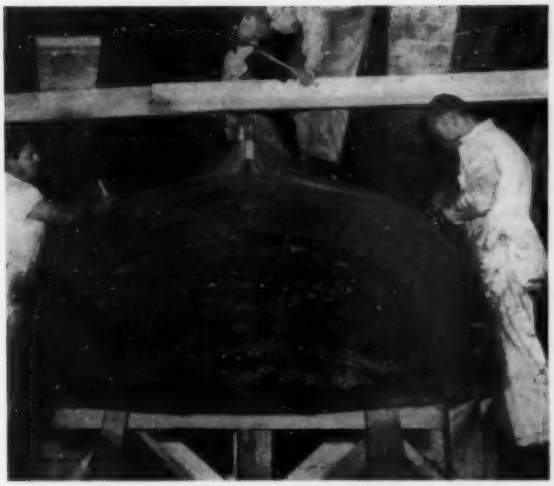


Fig. 1: Operators polishing wooden "plug" from which hull mold will be made. Before mold is laid up, plug is waxed and sprayed with polyvinyl alcohol release agent

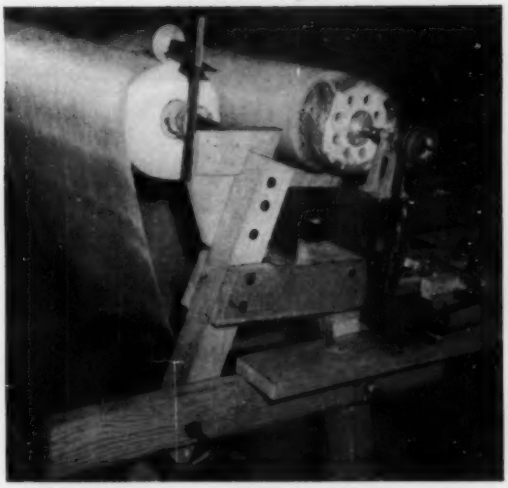


Fig. 2: Set-up for pre-impregnated woven roving for the hull mold. (Photos, Shell)

Boat mold for mass-production

Glass-reinforced epoxy resin shell, designed in two pieces, simplifies production of 41-ft. boats

*By Frederick M. Coleman**

When the first *Bounty II* sail-boat hull came off the production line, it represented a reinforced plastics production milestone for several reasons:

1) The reinforced plastics hull is the largest of its type ever designed for quantity production.

2) The hull mold of fibrous glass-reinforced epoxy resin is a major departure in tooling for hull construction, and is believed to be the largest mold ever made from this resin.

3) For the first time, the manufacture of sloops of this size has been placed on a production-line basis.

4) The use of reinforced plastics made possible a consumer price of two-thirds that of conventionally constructed wood sloops of the same size.

The *Bounty II* is 40.8 ft. long with a 28-ft. waterline length, 10.2-ft. beam, and 5.8-ft. draft. It is light in weight and has an exceptionally low center of gravity. These features permitted the designer to shape this low-displacement hull for low drag and good acceleration, even in light wind.

In order to lay up the reinforced plastics hull on an assembly basis, we first had to make a hull mold and a supporting cradle. The mold was laid up over the basic wooden boat hull "plug," and then split lengthwise into two parts, in "clam-shell" fashion. In production, the hull is laid up in the two separated mold sections and then bonded together. The cradle positions the two halves and then holds them together until the resin cures. One hull can be completed in less than three days.

Preparation of the mold required about 2500 lb. of Epon[1] 820 epoxy resin, which has exceptional dimensional stability, strength, and toughness, together with high heat-distortion temperature.

Construction of the mold began with the preparation of the "plug." This plug, actually a wooden replica of the hull-to-be, duplicates exactly the outside dimensions of the boat. It was made in about two weeks, using 1-in. pine strip-planking nailed and glued edge-to-edge. The strips were faired out over vertical station templets, each representing a section of the hull. Provision was made in the hull mold for water lines, discharges, intakes, and all through-the-hull fittings, which were indented so that they are flush with the hull after molding.

To achieve a smooth surface without having to cope with the problems of seams, caulking, etc., the strip planking was made with one concave edge and one convex edge. Planks so edged can run over a curve and still present a fairly uniform outside skin; they

* Vice President, Aeromarine Plastics Corp. (successor to Coleman Boat and Plastics Co.), Sausalito, Calif.

[1] Epon is a registered trademark of Shell Chemical Corp.

Fig. 3: Close-up of cradle mechanism shows how pipe is bonded to mold with fibrous glass tape to become an integral part of the overall lay-up

do not open at seams between planks as does square-section planking. Figure 1, p. 121, shows the plug from which the mold will be made being polished.

After the plug was planed, sanded, sealed, and polished, it was waxed and then sprayed with a polyvinyl-alcohol solution, the two coatings serving as the mold release. A 3/32-in.-thick layer of a die-facing epoxy resin was then brushed onto the mold and a single layer of glass cloth was applied. This layer was backed up with seven layers of standard, boat-woven, 60-end roving. The final thickness of the lamination was about 3/8 in. overall, except in those areas where additional layups were applied for reinforcement. The layers were cross-lapped to avoid uneven build-up; laps were also staggered to form stiffening ribs.

Thorough saturation of the woven roving was accomplished quickly and effectively on the pre-impregnating machine shown in Fig. 2, p. 121. There the unsaturated cloth was passed through the activated resin solution in the dip tank, rolled up, and then draped over the plug. No special surface coating was needed because the glass-epoxy combination was smooth enough after lay-up to provide a good finish. The laminate cured overnight at room temperature. The final step in construction of the mold was to attach the mold to the cradle.

The steel cradle or stiffening support, designed in advance and fabricated before and during the construction of the wooden plug and mold, was lowered onto the mold as it lay on the plug. Then it was securely bonded to the epoxy-glass shell by means of fibrous glass tape and angle lay-ups, to become an integral part of the shell. The details of some of these bonds are shown in Fig. 3, left.

The cradle is made largely of steel pipe, bent to the shape of the sections of the hull and carefully welded together and cross-braced. In addition, hollow-girder stiffeners of resin-bonded fibrous glass were taped along the outer rims of the mold halves, and steel-channel stiffeners were bonded to the bottom edges (or flanges) along which the two mold-halves meet. The finished mold is shown in the closed position in Fig. 4, below.

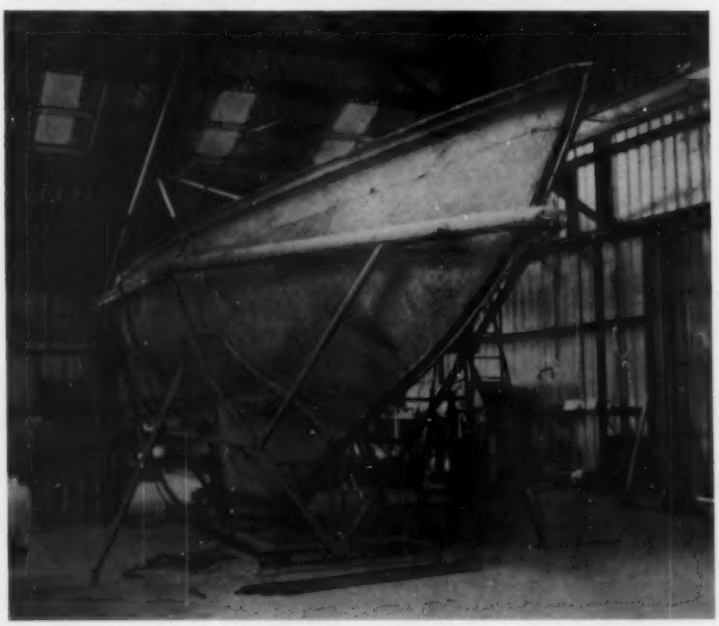
The mechanism which separates the halves is relatively simple. The mold is opened by slacking off on turnbuckles which connect each mold half to a steel track plate imbedded in the concrete floor of the plant. As the turnbuckles are slacked off, each mold half is held at the lip by an overhead hoist. The pipe braces are then cast loose from the connecting plate and the mold is lowered to the floor by means of a hoist, giving complete access to each half. Close fitting is achieved by means of register pins in the flange of the mold.

Molding the boat hull

To mold a hull, the separated mold halves are lined with a release agent and then covered with a colored gel coat. A layer of glass cloth is then stretched and fitted over the inside of the mold. On this cloth are laid up seven to 10 layers of polyester-resin-impregnated woven roving, the number depending on pre-determined need for extra strength.

The two laid-up half-sections of the hull are joined before the cure is complete, as follows: The female mold sections are raised, fitted together, and bolted in position; the junction of the hull halves is then taped and impregnated with additional resin. Thorough cure takes from four to six hours, after which the mold is removed and the hull moves along the production line.—END

Fig. 4: Finished hull mold in closed position. Inside surfaces of mold are dimensionally identical to outside surfaces of finished hull. To lay up new hull, the two parts of hull mold are separated by cradle



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Plastics Technical Section

Dr. Gordon M. Kline, Technical Editor

Evaluation of carbon black dispersions in polyethylene to predict weatherability

By Roger M. Schulken, Jr.,[†] *Gordon C. Newland,*[†] *and John W. Tamblyn*[†]

A procedure based on the use of a Photovolt transmission densitometer was developed for evaluating the degree of dispersion of carbon black in polyethylene films. Good correlation was found between the weathering resistance and the white-light absorptivity of such films. These absorptivity values were reproducible within ±3 percent.

Most of the polyethylene now being used in outdoor applications is pigmented with carbon black to protect the plastic from the deteriorating effects of sunlight. The importance of thorough dispersion of the pigment to obtain maximum stability has been emphasized, particularly by Wallder and his associates (1),[1] of the Bell Telephone Laboratories, who used a qualitative microscopic examination at a magnification of 100X to evaluate the degree of dispersion as satisfactory, fair, or poor. Weatherability, as measured by resistance to increase of the brittleness temperature, was found to show good correlation with these three degrees of dispersion. It is now desirable to assess more quantitatively the "satisfactory" dispersions to discover how far it is practicable to improve dispersion in the interests of better weatherability. The question is: Does weathering resistance level off within the easily attainable ranges of dispersion, or does it continue to increase beyond the limit easily reached with the present dispersing techniques?

A logical kind of quantitative measurement to make for the purpose of predicting weatherability would seem to be that of absorption of the near-ultraviolet rays, that is, the actinic segment of sunlight. Calculations by Ambrose (2) have shown that there is an optimum small particle size for which carbon black exhibits its maximum absorptivity in the near-ultraviolet region and that, in this region, the rate of increase of absorptivity with decreasing wavelength also reaches a maximum value. He therefore proposed, as a measure of dispersion, the slope of the reasonably linear plot of log optical density vs. log wavelength. The dispersion giving the maximum slope on such a plot would thus be expected to show the best weathering resistance.

Spectroscopic measurements of the degree of dispersion of carbon black in polyethylene have been investigated in many laboratories with a variety of instruments. A recent round-robin experiment, conducted by the American Society for Testing Materials, revealed the startling fact that the measurement of absorptivity of black polyethylene compositions is by no means a simple task. Reproducibility of measurements was not good even within one laboratory on a single instrument. Among different laboratories, it was discouragingly poor. Part of the trouble appeared to be the difficulty of preparing, with sufficient uniformity of thickness, the very thin films necessary to bring the optical density within the fairly low range required by most of the available instruments. Another difficulty encountered was a peculiar dependence of absorptivity, or apparent absorptivity, on film thickness. The absorptivity, defined as optical density (corrected for reflection, scatter, and absorption by the polyethylene itself) divided by [film thickness (cm.) × concn. of carbon black (g./cc.)], was observed to increase as film thickness decreased in the case of good dispersions of fine-particle-size blacks;

* Reg. U.S. Pat. Off.

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† Research Laboratories, Tennessee Eastman Co., Div. of Eastman Kodak Co., Kingsport, Tenn.

[1] Numbers in parentheses link to references at end of article, p. 200.

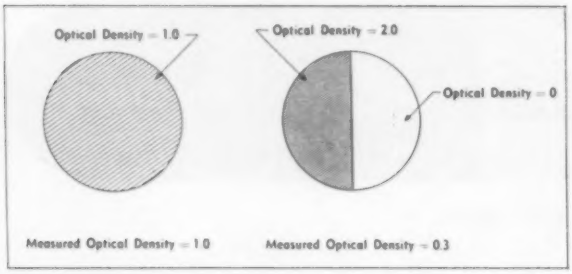

Fig. 1: Effect of film nonuniformity on optical-density measurements by scanning the entire area of the sample

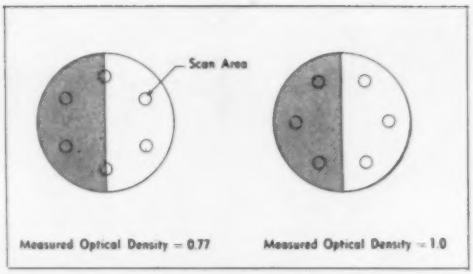

Fig. 2: Effect of film nonuniformity on optical-density measurements, using the method of averages

this effect was especially pronounced at the shorter wavelengths.

Techniques recommended

Recommended methods of minimizing these difficulties are outlined here (3):

1) To overcome nonuniformity of film thickness and arrive at a better measure of average optical density—

a) Use a Photovolt Corp. transmission density unit model 52 with photometer model 520-M (4), which will measure optical densities up to about 7. This instrument makes it possible to measure the light transmission of films 2 to 2½ mils thick containing 3% of well-dispersed fine-particle-size carbon black.

b) Take the average of the optical densities of six symmetrically distributed small areas rather than a single optical density of a large area. The latter can be quite far from the true average optical density in cases where the film uniformity is poor. Figures 1 and 2, above, illustrate two extreme cases for a material having a true average optical density of 1.0. The circle on the left in Fig. 1 represents the case of a film of uniform thickness. The use of any suitable transmission measurement would lead to the correct value, 1.0, for the optical density of this film. The circle on the right represents an extreme case of nonuniformity in which all of the light-blocking material is compressed into the left-hand half of the circle. A single transmission measurement covering the whole area of this circle would lead to the false value of 0.3 for the optical density of this film.

To minimize this error we recommend the procedure illustrated by Fig. 2. The averaging of six transmission measurements, made on the six small circular areas, would lead to the correct value of optical density, 1.0, when the small areas are distributed as in the circle on the right. At worst, the quite improbable distribution shown in the circle on the left of Fig. 2 would lead to a minimum value of 0.77 for the measured optical density.

The special holder built for multiple scanning of each film sample is shown in Fig. 3, below. The positioner is mounted directly on the stage of the density unit. The sample holder may be turned freely in the semicircle cut into the positioner. Both parts are made of black plastic. Only one positioner is needed. Several of the circular parts may be prepared if required. In the lower part of the figure is a side view showing the construction of the sample holder.

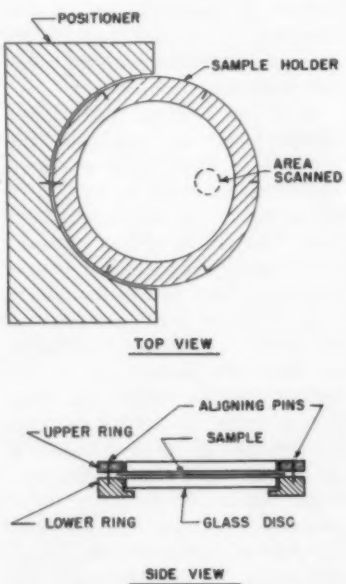

Fig. 3: Top and side views of sample holder for scanning

A view of the Photovolt Corp. transmission density unit is given in Fig. 4, p. 127. The sample holder of Fig. 3 can be mounted on the stage above the lamp.

2) To overcome the dependence of absorptivity on thickness in the thinner films—

a) Plot optical density vs. thickness for two or more films of different thicknesses and interpolate to obtain the optical density at some arbitrary thickness, say 1 to 2 mils. Calculate the absorptivity at the selected thickness.

b) Use unfiltered white light or light from a filter at some medium wavelength.

We have obtained data which emphasize the need for more careful standardization of the optical absorptivity measurement, particularly in regard to film thickness. We wish to present these data here and discuss their usefulness as weatherability indicators.

Precautions to be observed in the use of the Photovolt densitometer:

1) Since the Photovolt photometer is very sensitive to light, all sources of extraneous light must be eliminated.

a) The apparatus as supplied from the Photovolt Corp. requires that the insertion of black, tight-fitting sleeves around the filters in the filter turret to prevent light leaks (see Fig. 5, p. 127).

b) The mount for the search arm is insufficient to prevent pivoting when handled. A second mount near the rear of the search

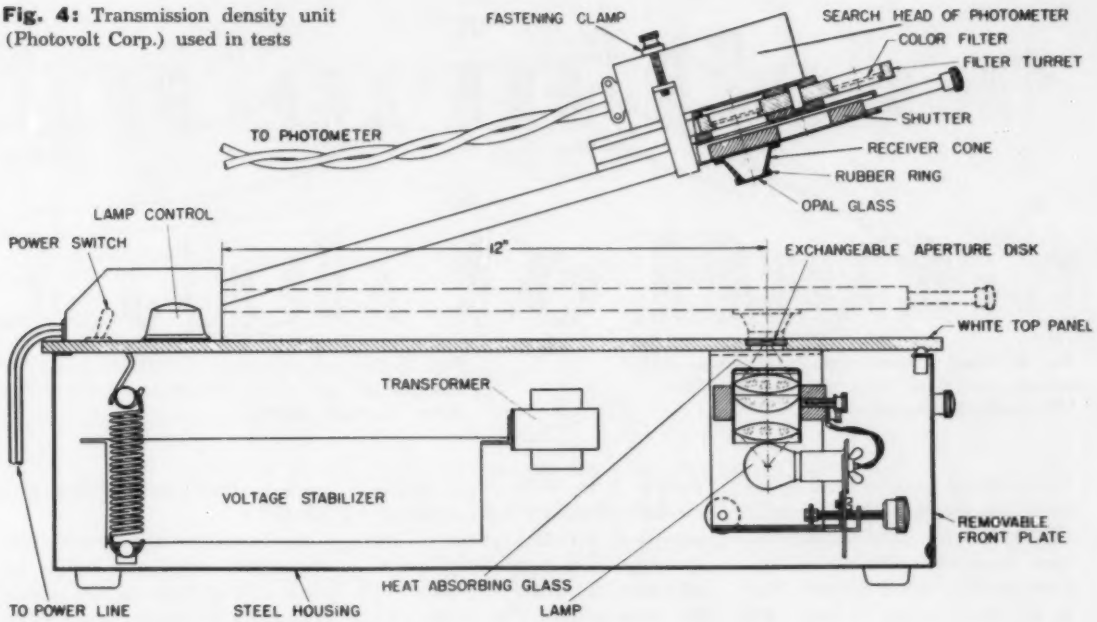

Fig. 4: Transmission density unit (Photovolt Corp.) used in tests

head which will hold it securely both vertically and horizontally is required.

c) The pressure applied to the search head in measuring position is variable, depending on the operator and time required to read the meter. If insufficient pressure is applied or if the pressure is relaxed during the reading, a light leak occurs around the rubber ring of the search head.

d) Measurements must be made in a very dark room. The photometer dial light should be turned away from the search head.

If a dark room is not available, a cover may be made for the instrument. The entire density unit may be covered or a small shield may be made to fit over the sample holder. We used the latter arrangement in the form of a box that closes as the search head is lowered. This box must be very precisely made.

2) Film samples must be handled with care.

a) The film sample should be tight and free from wrinkles.

b) Pressed films and extruded films occasionally have small pinholes. These should be avoided or the measurement should be taken in areas where the pinholes do not interfere.

c) Fingerprints on the cover glass or filters should be avoided.

d) A correction should be made for the reflection of a blank of the same thickness as the film to be measured.

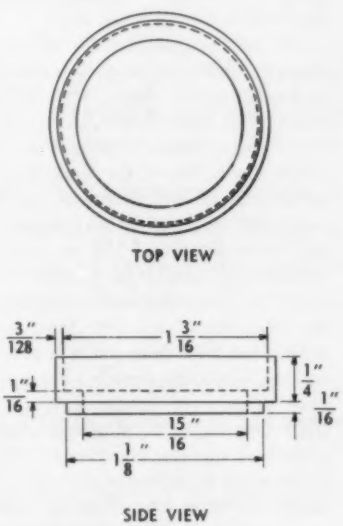

Fig. 5: Sketch of sleeve for filter turret

3) The instrument must be properly adjusted.

a) The zero adjustment should be made with the sample holder in place. If the sample holder is removed during the zero adjustment, the angle of the search head is changed.

b) The inter-range zero should be checked frequently. Jamming or long periods of inactivity will cause the inter-range zero to become unbalanced. The inter-range zero is also shifted if the needle is allowed to go off scale.

c) Care should be taken to close the shutter before the filter turret is turned; the light leak during this operation will cause the needle to go off scale if the shutter is open.

d) Neutral density filters are not independent of wavelength; the density of each filter should be measured at each wavelength used. The difficulty of measuring the density of a neutral density filter without either changing the angle of the search head or the sample position requires that a well-dispersed black film be used as a neutral density substandard.

Experimental results

Absorptivity measurements: Polyethylene films containing 0.25% of a fine-particle-size channel black were examined with light of five different colors. The dependence of optical density on wavelength and film thickness is illustrated in Fig. 6, p. 128. Straight lines have been drawn through the points for each wavelength. Note that the intercepts on the optical density axis are not zero but increase with decreasing wavelength. (Actual optical densities of films approaching zero thickness would, of course, also approach zero; therefore, the true

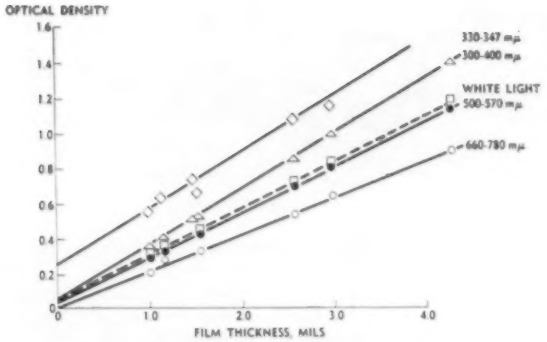

Fig. 6: Effect of wavelength and thickness on optical density of black polyethylene films. (Photovolt densitometer)

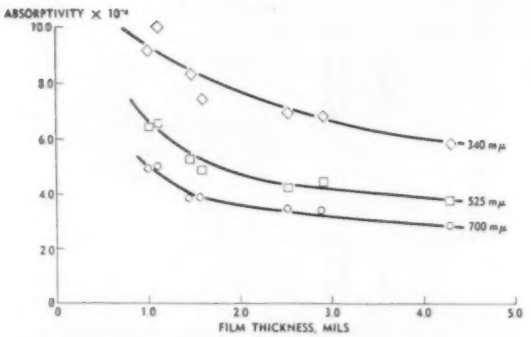

Fig. 7: Effect of wavelength and thickness on absorptivity of black polyethylene films. (Cary spectrophotometer)

curves would have to bend in toward the origin.) This behavior was typical for good dispersions. Poor dispersions showed an approximately normal pattern, that is, all lines passed through the origin. The increase in absorptivity with decreasing film thickness, implied in Fig. 6, is more strikingly shown in Fig. 7, above.

It should be noted that the departures from normality illustrated by Figs. 6 and 7 are not confined to the data obtained with the Photovolt densitometer but were also observed with Cary and General Electric spectrophotometers, with the Eastman Kodak color densitometer, and with the Gardner Hazemeter. Moreover, the same phenomenon was recently observed by Agar (5) in measurements of the optical density of thin films of evaporated carbon on glass slides. It is of interest to note that his 1000-A.-thick film had an optical density of 1.0—equal to the value which we found for the same amount of carbon, in the form of fine-particle-size channel black, well-dispersed at a concentration of 1% throughout a 1-mil-thick polyethylene film. Agar also observed the same relation that we did between white and green light, that is, optical densities were a few percent higher in white light.

We see no worthwhile advantage to be gained from the use of monochromatic light, especially ultraviolet. Indeed, one can imagine disadvantages arising from a requirement based on monochromatic absorption. For example, if a certain level of optical density at a wavelength of 350 mμ were specified, it might be simpler to meet this requirement by adding an ultraviolet absorber than by taking the trouble to make a good carbon-black dispersion. An optical density of 1.0 in a 1-mil-thick film could be obtained over a limited wavelength range with 0.2 to 0.3% of a strong ultraviolet absorber. Most absorbers of this type would do more harm than good to the weatherability of a plastic.

Returning to the round-robin experiment mentioned earlier, we show in Fig. 8, below, the optical density vs. thickness curves which we obtained for three of the 10 compositions distributed by the American Society for Testing Materials for this experiment. These three represent the spread of behavior observed among all 10 formulations and illustrate the small amount of experimental scatter in the measured points. No simple relation has been found between the optical densities and the qualitative microscopic dispersion ratings. This is further illustrated by Fig. 9, below, in which the curves for all of the round-robin compositions are shown. For example, RR-8, rated a poor dispersion by microscopic examination, showed a high optical density, while RR-5, rated good, showed a rather low optical density.

Correlation of absorptivity with

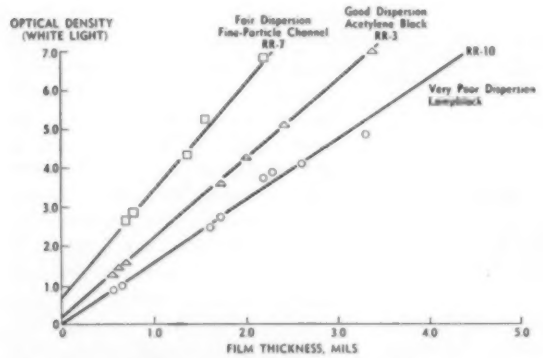

Fig. 8: Optical densities of three A.S.T.M. round-robin compositions tested

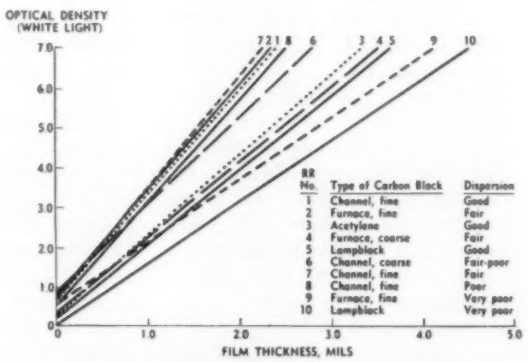

Fig. 9: Optical densities of all ten A.S.T.M. round-robin compositions tested

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weatherability: Information on the weatherability of these black polyethylene compositions is needed before it can be decided whether an optical measurement is suitable for predicting weatherability, or before the best optical measurement to use can be chosen. Any one of several parameters from the curves of Fig. 9 might be used—slope, intercept on the optical density axis, or absorptivity at some given film thickness.

We have experiments under way to evaluate the weatherability of the 10 round-robin compositions, both outdoors and in a laboratory weathering apparatus. Each composition was compression molded to a film 2 to 3 mils thick which was then cut into 2.5- by 0.5-in. rectangular strips for exposure. As exposure progresses, the weathering damage is being evaluated by tensile elongation measurements on the strips. The artificial weathering is being done in an Atlas Twin-Arc DLTS-type Weather-Ometer modified (6) by the addition of 10 Westinghouse 20-w. fluorescent sun lamps. The results obtained to date are shown in Table I, above.

Table I: Weathering resistance of films of A.S.T.M. round-robin black polyethylene compositions

RR No.	*Type of carbon black*	*Microscope dispersion rating (100X)*	*Original elongation retained after 375 hr. in Weather-Ometer*	*White light absorptivity at thickness of 1 mil*	*Oven life at 160° C.*
			%	*g.$^{-1}$cm.^{2}*	*hr.*
1	Channel, fine	Good	88	45,000	26
2	Furnace, fine	Fair	68	49,000	23
3	Acetylene	Good	55	33,000	42
4	Furnace, coarse	Fair	57	32,000	26
5	Lampblack	Good	51	28,000	24
6	Channel, coarse	Fair-Poor	82	46,000	10
7	Channel, fine	Fair	64	45,000	35
8	Channel, fine	Poor	69	44,000	35
9	Furnace, fine	Very poor	41	31,000	9
10	Lampblack	Very poor	25	22,000	9
Control	None	—	0	0	3

The Weather-Ometer data, shown in column 4, were interpolated from measurements made after three different exposure times—330, 543, and 982 hours. Comparison of columns 4 and 5 shows that the retention of toughness by the black films in the Weather-Ometer correlates fairly well with their absorptivity of white light at a film thickness of 1 mil.

As a group, RR compositions, 1, 2, 6, 7, and 8, with high white-light absorptivities, had the best weathering resistance. RR compositions 3, 4, 5, and 9, with intermediate absorptivities, had intermediate weathering resistance. RR-10, with the lowest white-light absorptivity, had the least weathering resistance.

Correlation between columns 3 and 4, on the other hand, is not very good. For example, the low-power microscope ratings for RR compositions 3, 5, 6, and 8 seem quite out of line with their weatherabilities and white light absorptivities. Two of the investigating laboratories gave "satisfactory" microscope dispersion ratings (that is, grade A or B) to RR-1, 2, 3, 4, 5, and 6 and "unsatisfactory" ratings (that is, grade C or D) to RR-7, 8, 9, and 10. However, according to the weatherability and absorptivity data, RR-7 and 8 would be rated satisfactory and RR-3, 4, 5, and 9, intermediate.

Thermal oxidative stability: The last column of Table I gives, as a measure of thermal oxidative stability, the times required at 160° C. for the appearance of measurable peroxide content in the round-robin compositions. This measurement was developed by C. E. Tholstrup, of our laboratories. Since carbon blacks act as mild antioxidants for polyethylene (7), it was thought that their effectiveness in this respect might be quite sensitive to their degree of dispersion in the plastic. The oven-life test might thus give a good measure of dispersion and, consequently, of weatherability characteristics.

Moreover, because secondary thermal reactions play a part in the over-all weathering process, the heat stability of the plastic should make a direct contribution of its own to the weatherability. Addition of antioxidants to pigments has been observed to greatly increase their effectiveness in protecting plastics against weathering breakdown (8). As the temperature of the weathering exposure increases, the contribution of heat stability to weatherability would be expected to increase.

There is obviously little correlation, as shown by Table I, between oven life and Weather-Ometer resistance. For predicting the results of exposure in the tropics, the data of column 6 could perhaps play a more significant part. At any rate, it is suggested that measurements of both absorptivity and oven life might be combined in some appropriate manner to give a better forecast of weatherability of black polyethylene compositions than that provided by absorptivity measurements alone.

Electron microscopic examination: The most direct method of examining the state of dispersion of carbon black in polyethylene would be that of electron microscopy. By this method the state of subdivision of the pigment in the yellow-brown background, unresolved by low-power microscopy, might be determined. It is the degree of dispersion in this background which should govern the stabilizing efficiency of the carbon black. Up to the present time, however, it has been difficult to obtain sufficient contrast be-

(*To page* 200)

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Creep and stress-rupture behavior of rigid PVC pipe—Part 2

*By J. H. Faupel**

Part 1 of this article, which appeared last month, presented the theoretical principles connecting creep and stress-rupture, under combined stresses, for both isotropic and anisotropic materials. Some short-time test results obtained on PVC pipe were also given. Part 2 presents the results of tests on creep, stress-rupture and stress-relaxation, and discusses the test results and their interrelations on the basis of the existing theory.

Creep and stress-rupture tests: Creep and stress-rupture tests in tension on full size 2-in. Schedule 80 PVC pipe and on pipe subjected to combinations of internal pressure and tension have been conducted at 73° F.; tests at temperatures to 150° F. are still under way. The results of the tension creep tests are shown in Fig. 4, below, and discussed in the section on correlation of data, p. 134.

In conducting stress-rupture tests on pipe subjected to internal pressure two systems were used depending on the loading conditions. Most of the tests were conducted on 2-in. Schedule 40 and Schedule 80 PVC pipe using a filler bar with "O" ring seals. In these tests nitrogen gas pressure was admitted in about 15 sec. and held constant until failure occurred. The appearance of Schedule 40 pipe so tested is shown in Fig. 5, p. 134. Other tests were conducted on 2-in. Schedule 80 PVC pipe by using both internal pressure (water) and externally applied tension; thus, for this size pipe tests were conducted with the following ratios of longitudinal to hoop stress:

$\sigma_a/\sigma_h = 0$; "open-end" pipe under internal pressure; $\sigma_a/\sigma_h = \frac{1}{2}$; "closed-end" pipe under internal pressure; $\sigma_a/\sigma_h = 1$; "closed-end" pipe + added tension; $\sigma_a/\sigma_h = 2$; "closed-end" pipe + added tension; and $\sigma_a/\sigma_h = \infty$; pure tensile test in longitudinal direction. The results of all of the stress-rupture tests are plotted in Fig. 6, p. 136. For simplicity the state of stress in pipe wall was calculated by Eq. 23. Thus, to find actual pressure and external tension refer to Table III, p. 136.

It is interesting for this material, that the stress-rupture life is expressed by a straight-line relationship. Note, as compared with short life (8000 p.s.i., Fig. 6, p. 136, that there is a nearly 40% decrease in stress for failure at 10,000-hr. life. More will be said about these results in the section of the paper on correlation. Strain data for these tests are not available except for the tension tests (Fig. 4) and one pipe which was under 1000 p.s.i. internal pressure (Fig. 7, p. 136).

Stress-relaxation tests: In this test a specimen is strained to some predetermined deformation (usually well below the ordinary yield strength) and the stress required to maintain the constant deformation measured as a function of time. Results of such tests carried out over a 10-hr. period have been shown by MacLeod (4)[1] and others to give a good indication of the creep behavior of plastics subjected to steady loads for long periods of time. We conducted two types of stress-relaxation tests: tests on tension specimens and tests on "open-end" pipe pressurized to a constant radial expansion. Through such a procedure the material can be characterized in both the longitudinal and transverse directions—this is very important since pipe may be anisotropic. In the tests on PVC we used full-size 2-in. Schedule 80 pipe, a loading time of about 5 to 8 sec. and a relaxation period of 5 to 8 hr.; results at 73° F. are plotted in Fig. 8 as

[1] Numbers in parentheses link to references listed at the end of Part 1 of this article, MODERN PLASTICS 35, 188 (July 1958).

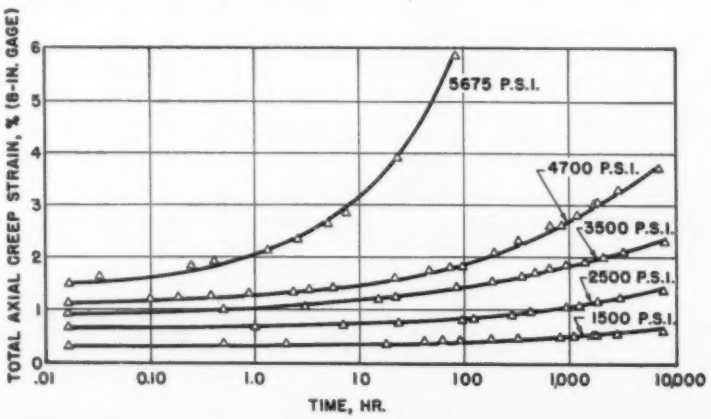

Fig. 4: Tensile creep behavior of 2-in. Schedule 80 PVC pipe at 73° F.

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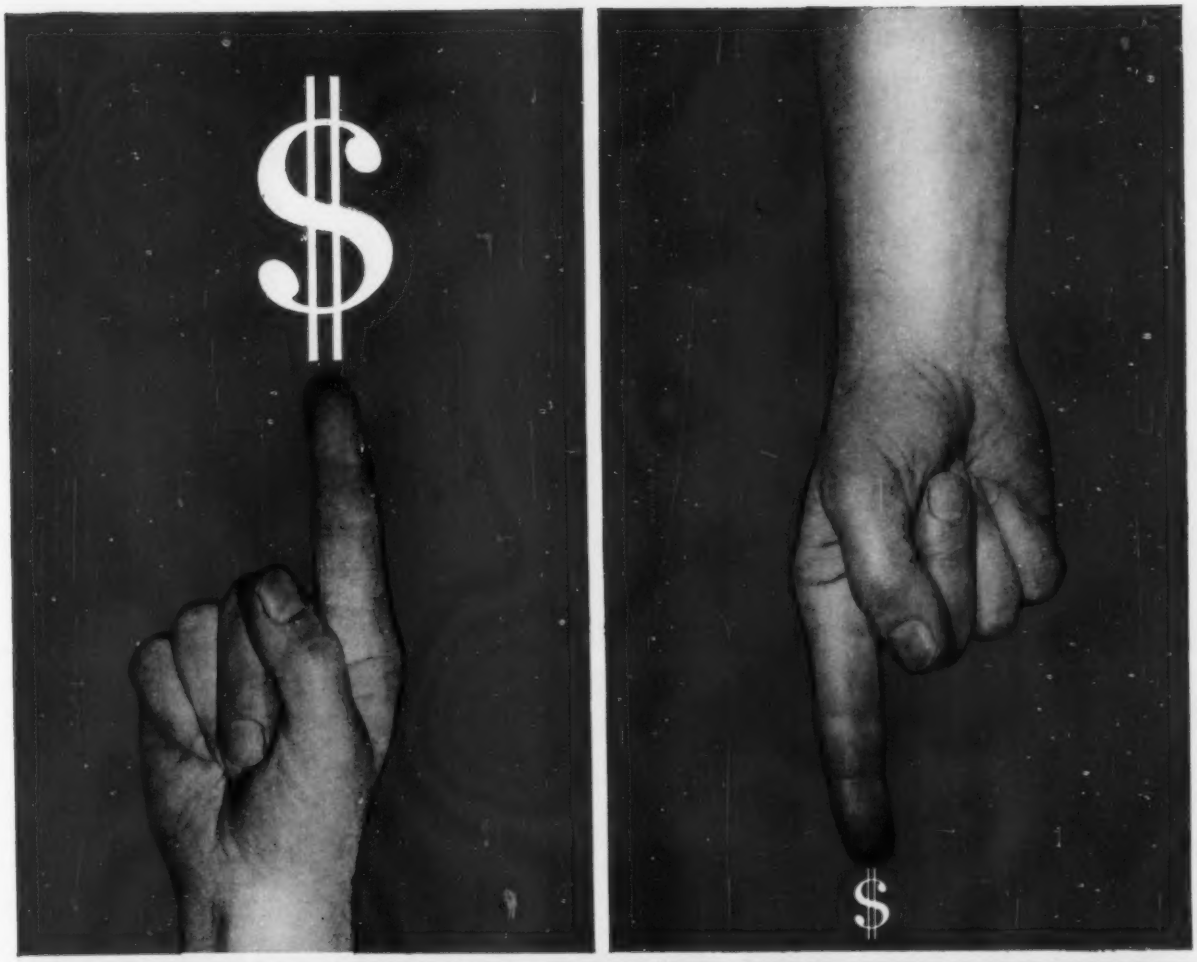

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decay of stress *vs.* time on a logarithmic scale. It is not clear how the plots go at times below the value of 0.01 hr.; therefore, in using these data for correlation work we have not attempted to make any prediction below this time.

Discussion and correlation of data

Short-time burst tests: Internal pressure tests conducted on 2-in. Schedule 40 and Schedule 80 PVC pipes using a filler bar with "O" ring seals are of the "open-end" type in which the maximum values of the principal stresses are

$$\sigma_h = \frac{pd_i}{2t} \qquad \text{Eq. 36}$$

$$\sigma_r = -p \qquad \text{Eq. 37}$$

$$\sigma_z = 0 \qquad \text{Eq. 38}$$

The prediction of the bursting pressure of pipe on the basis of an analysis of tensile test data was examined by several methods, the results from two of which are reported here. In the first method the hoop stress, σ_h, in Eq. 36 is replaced by the ultimate transverse tensile strength, σ_u, so that

$$p_b = 2\sigma_u \frac{t}{d_i} \qquad \text{Eq. 39}$$

This method gives good results for PVC as shown in Table II. The other method utilizes the effect of all principal stresses and includes consideration of anisotropy, if present. The "equivalent" stress, $\bar{\sigma}$, is related to the principal stresses in accordance with Eq. 24, and failure pressure for a closed-end pipe is given by Eq. 34. For the open-end pipe and for an isotropic open-end pipe

$$p_b = \frac{\bar{\sigma}}{\sqrt{\frac{1}{4}\left(\frac{d_i}{t}\right)^2 + \frac{1}{2}\left(\frac{d_i}{t}\right) + 1}} \qquad \text{Eq. 41}$$

where $\bar{\sigma}$ is now the ordinary tensile strength of the pipe. The results given in Table II under the heading of "general theory" were calculated using Eq. 41, since PVC appears to be isotropic for a short-time loading.

The results correlated quite well ($< 20\%$ deviation) and are all on the "safe" side when calculated by the general theory. This theory assumes that failure starts at the inside diameter of the pipe, and is an attempt to relate physical behavior on a fundamental basis and to account for any factors known to influence the results. Stress concentration effects can also be allowed for in the general theory by simply applying the appropriate stress-concentration factor to the individual stress terms. This theory is also of considerable value in analyzing more complicated stress problems than open-end pipe as will be shown in the

$$p_b = \frac{\bar{\sigma}}{\sqrt{\frac{1}{4}\left(\frac{\alpha d_i}{t}\right)^2 + (1 - \alpha^4 + \alpha^2) + \frac{d_i}{2t}(2\alpha^2 - \alpha^4)}} \qquad \text{Eq. 40}$$

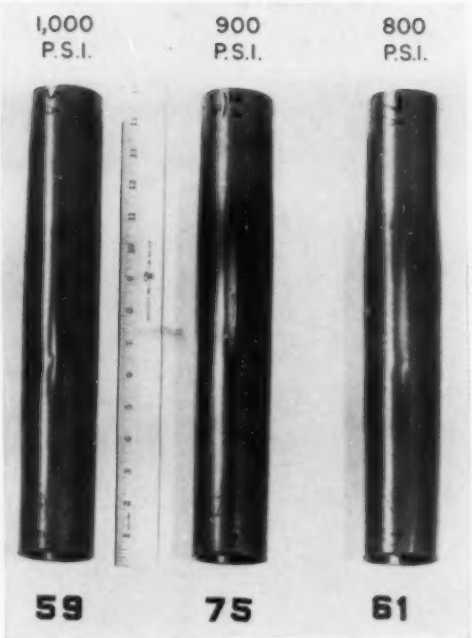
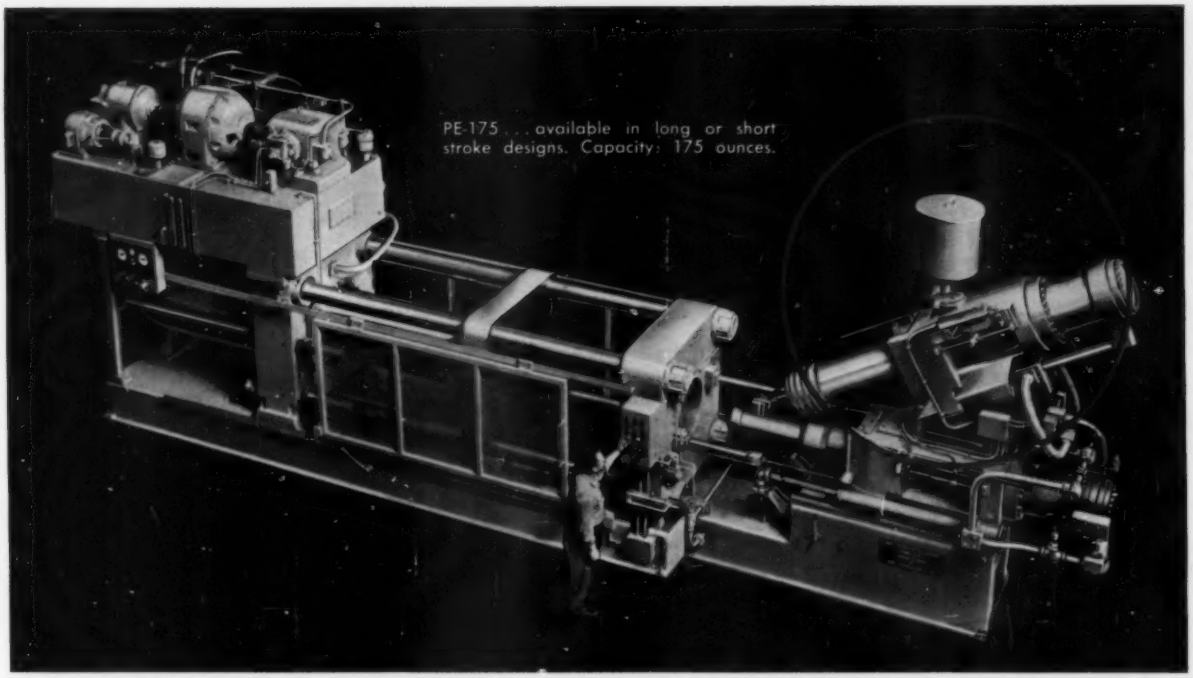


Fig. 5: Pressure stress rupture tests on 2-in. Schedule 40 polyvinyl chloride pipe at 73° F.

Definitions of symbols used in equations

B = bulk modulus, p.s.i.
E = modulus, p.s.i.
E_o = instantaneous modulus, p.s.i.
I = moment of inertia, in.^{4}
L = length, in.
M = moment, in.-lb.
T = time
W = total load, lb.
X, Y, Z = constants, see text.
a = radius of circular plate, in.
b = relaxation parameter, hr.
c = distance from neutral axis to furthest stressed fiber in beam, in.
d_i = inside diameter of pipe, in.
e = base of natural logarithm
m = relaxation parameter
p = internal pressure, p.s.i.
p_b = bursting pressure of pipe, p.s.i.
t = thickness, in.
$\alpha = \sigma_{02}/\sigma_{01}$
$\beta = \sigma_{03}/\sigma_{01}$
δ = deflection, in.
ε = strain, in./in.
$\varepsilon_1, \varepsilon_2, \varepsilon_3$ = principal strains, in./in.
$\varepsilon_{01}, \varepsilon_{02}, \varepsilon_{03}$ = particular strains, in./in., see test
ε_o = initial elastic strain, in./in.
η = viscosity
μ = Poisson's ratio
π = constant, 3.1416
σ = stress, p.s.i.
$\bar{\sigma}$ = equivalent stress, p.s.i.
$\sigma_1, \sigma_2, \sigma_3$ = principal stresses, p.s.i.
$\sigma_{01}, \sigma_{02}, \sigma_{03}$ = particular test stresses
σ_o = initial tensile stress, p.s.i.
$\sigma_h, \sigma_r, \sigma_z$ = principal stresses in pipe (hoop, radial, longitudinal) p.s.i.
σ_u = ultimate tensile strength, p.s.i.
τ = relaxation time



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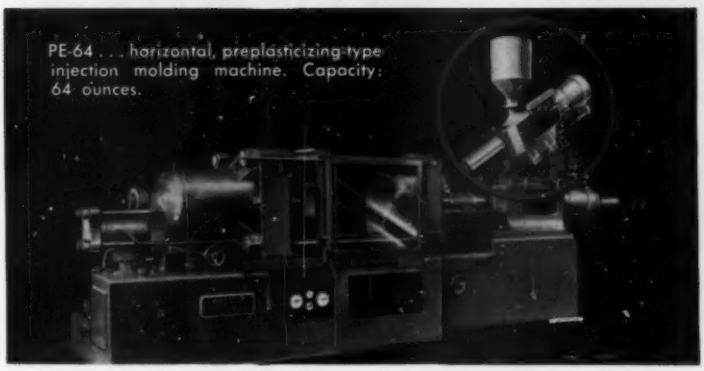

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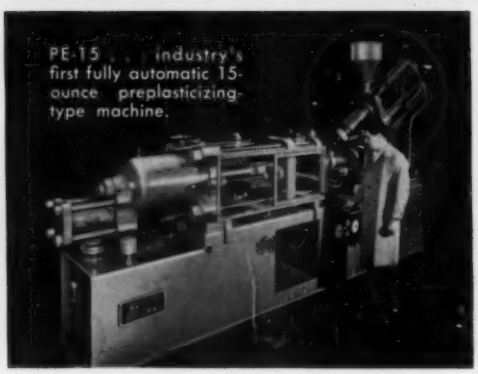

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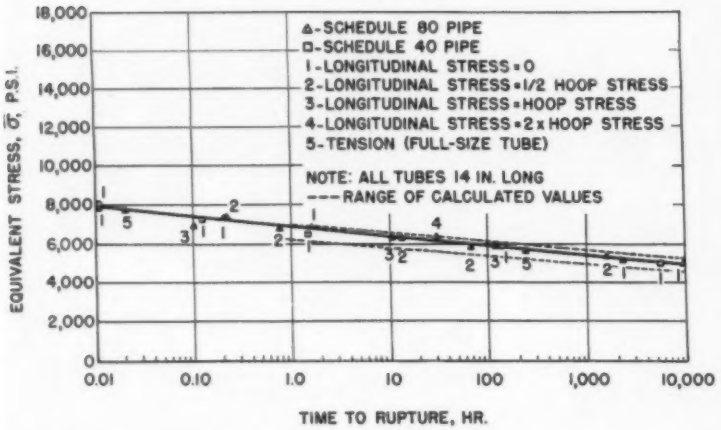


Fig. 6: Stress-rupture data for 2-in. PVC pipe at 73° F.

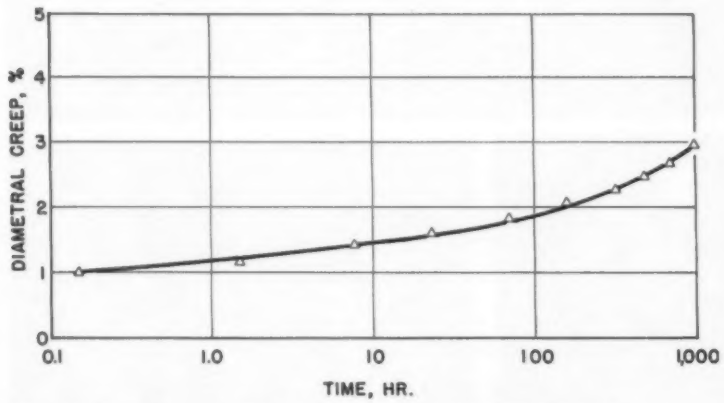


Fig. 7: Pressure creep data for 2-in. Schedule 80 PVC pipe under 1000 p.s.i. internal pressure at 73° F.

Table III: Stress formulas for pipe

Stress ratio	*Internal pressure, p*	*External tension*
σ_z/σ_h	p.s.i.	p.s.i.
0	$\bar{\sigma}\left[\frac{1}{4}\left(\frac{d_i}{t}\right)^2+\frac{1}{2}\left(\frac{d_i}{t}\right)+1\right]^{-\frac{1}{2}}$	0
$\frac{1}{2}$	$\bar{\sigma}\left[\frac{3}{16}\left(\frac{d_i}{t}\right)^2+\frac{3}{4}\left(\frac{d_i}{t}\right)+1\right]^{-\frac{1}{2}}$	0
1	$\bar{\sigma}\left[\frac{1}{4}\left(\frac{d_i}{t}\right)^2+\left(\frac{d_i}{t}\right)+1\right]^{-\frac{1}{2}}$	$\frac{pd_i}{4t}$
2	$\bar{\sigma}\left[\frac{3}{4}\left(\frac{d_i}{t}\right)^2+\frac{3}{2}\left(\frac{d_i}{t}\right)+1\right]^{-\frac{1}{2}}$	$\frac{3pd_i}{4t}$
∞	0	$\bar{\sigma}$

section on stress-rupture under combined stresses. For design estimates, Eq. 39 is adequate for determining the ordinary short-time burst pressure.

Creep and relaxation tests: MacLeod (4) has demonstrated the use of linear viscoelastic theory for predicting creep for many amorphous and crystalline plastics and for both filled and laminated materials for stresses below about 50% of the ordinary yield strength. The stress-relaxation data for PVC pipe are shown in Fig. 8. In these tests the initial load was applied in 5 to 10 sec. and the resulting deformation held constant for nearly 10 hr., the decay of load being noted as a function of time. The fact that there are two relaxation curves indicates anisotropy of creep properties for the PVC pipe. The plots in Fig. 8 plus Eq. 18 give values of the "time-modified" modulus and from these moduli values predictions of creep can be made by means of Eq. 15. Experimental tension creep data for PVC are shown in Fig. 4 and for a PVC pipe subjected to 1000 p.s.i. internal pressure, in Fig. 7.

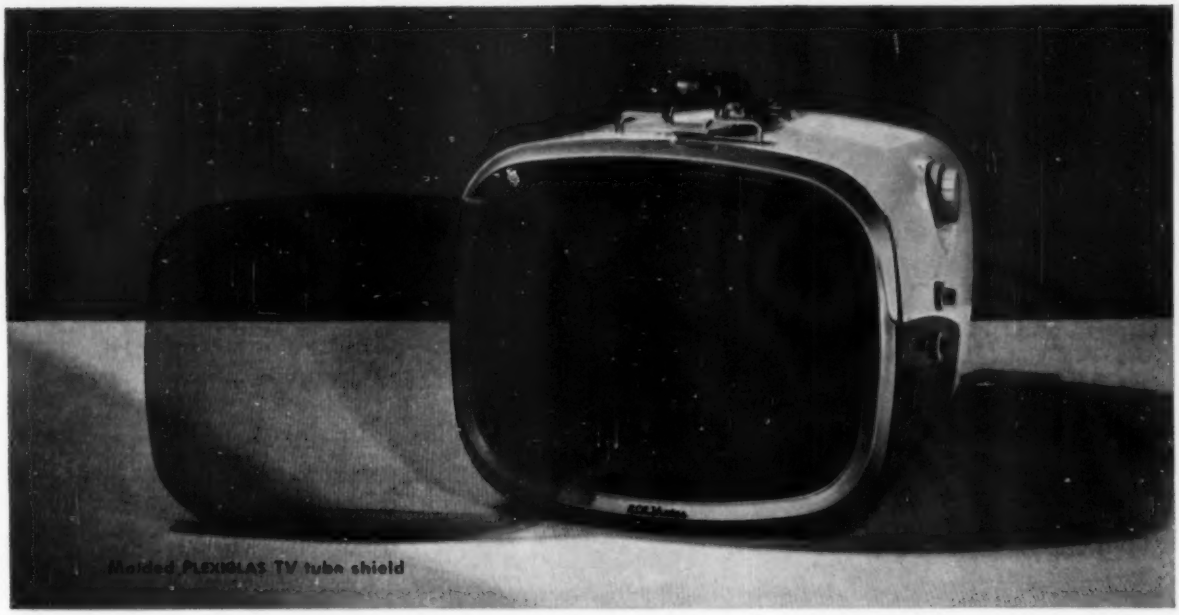
The tension curve in Fig. 8 is used to predict the curves in Fig. 4 and the pressure curve in Fig. 8 is used to indicate the curve in Fig. 7.

When predictions are made by selecting a time and observing the creep strain at that time, theory is satisfactory to about 1.75% creep for PVC and the predictions are good to within an *order* of *magnitude* of time for creep strains of about 1.75% ± about 4 percent. For most practical cases such deviations are not important since we usually want to know whether a structural or machine part will operate satisfactorily for a given proposed life.

Stress-rupture and relaxation tests: It was previously mentioned that there appeared to be a correlation between stress-rupture and stress-relaxation for PVC.

The procedure used to correlate stress-relaxation and stress-rupture is as follows:

a) Conduct the stress-relaxation test in the principal directions; for pipe this would be



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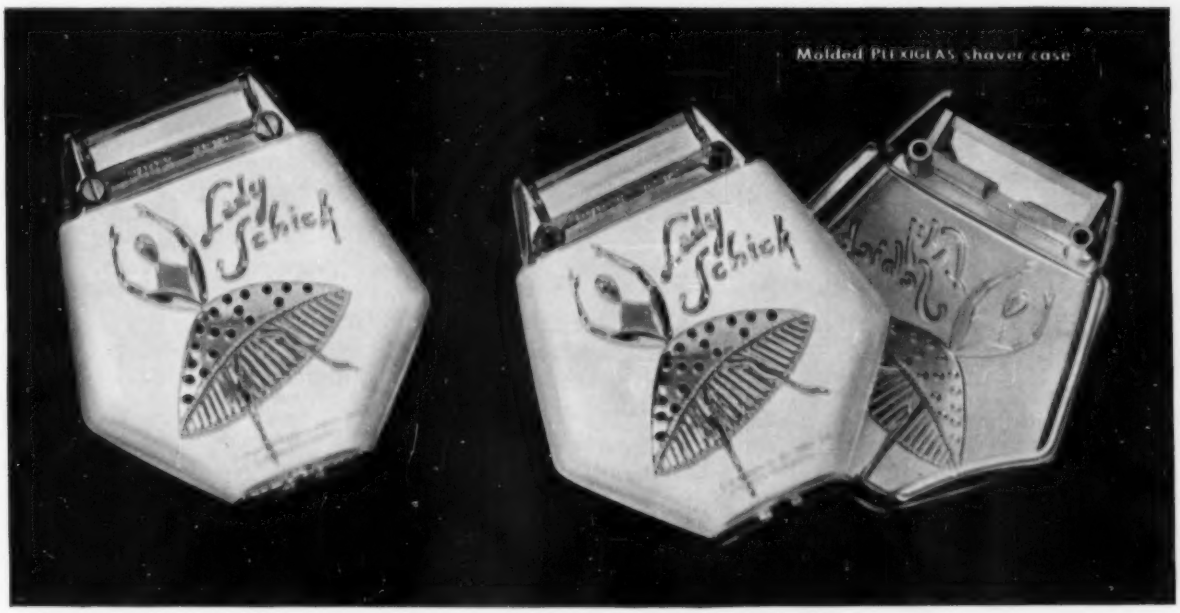

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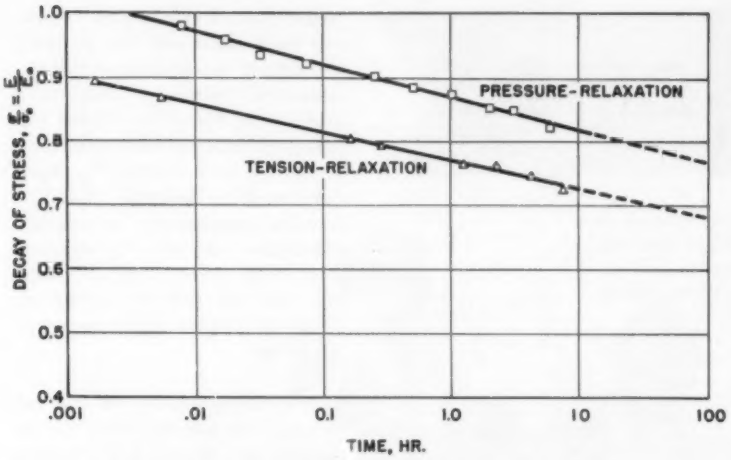

Fig. 8: Relaxation characteristics of PVC extruded pipe at 73° F.

Table IV: Wall stress for various span lengths of 2-in. Schedule-80 PVC pipe holding water at 50 p.s.i. and 73° F.

Span length	*Equivalent stress, $\bar{\sigma}$*	
	O.D.	*I.D.*
ft.	*p.s.i.*	*p.s.i.*
2	193	267
4	199	284
8	279	366
10	372	442
15	740	738

longitudinally and transversely as shown in Fig. 8.

b) Conduct rupture tests in the principal directions, using loading times comparable to those used in performing the stress-relaxation tests.

c) Construct a composite stress-relaxation curve depending on the principal stress ratio involved. For example, in Fig. 8 with $\sigma_z/\sigma_h = 1.0$, the composite would be midway between the two curves on the figure.

d) Determine the rupture stress corresponding to any given time. This is done by noting the decay of load (or stress) on the ordinate of the composite stress-relaxation curve at the time in question and using the equation below with the initial value being the short-time rupture value (tensile load or internal pressure as the case may be)

$$\text{decay of load} = \frac{\text{load at any time}}{\text{initial load}}$$

The results from applying such a procedure are shown in Fig. 6 as broken lines which represent the range of predicted values, the top line being for pure internal pressure and the bottom line for pure tension.

Table V: Creep deflections of loaded PVC pipe

Span length	*Max. deflections*[a]	
	Initial, δ_0	*After 10,000 hr.*
ft.	*in.*	*in.*
2	0.000428	0.00072
4	0.00683	0.01147
8	0.109	0.1835
10	0.268	0.4500
15	0.418	0.7050

[a] The slight contribution to the deflection due to internal pressure has been omitted here.

Figure 6 illustrates the simplicity and reliability obtained in calculating equivalent stresses by a general stress-strain relation (Eq. 23); the maximum deviation of theory from experiment in this case is less than 10% when comparing equivalent stresses for rupture at any particular time. However, because of the very gentle slope of the plot of stress vs. life (Fig. 6), the error in predicting life from stress is much larger, about an order of magnitude. Where the designer wants to be reasonably certain of achieving a minimum service life, he would be wise to choose a design life about 10 times the desired minimum. The penalty in equivalent stress of this safety factor in life is small.

As was pointed out earlier, only one plot is required for analyzing a multiplicity of stress ratios and geometries. Figure 6, for pipe, for example, contains data obtained with both Schedule 40 and Schedule 80 pipe. Similar calculations were made using the maximum stress theory, referred to in the previous section on short-time bursting of pipe, and it was found that deviations of the order of 15% were obtained; the largest deviations occurred for stress ratios of 1 and 2.

With regard to the above analyses two important considerations should be noted. First, all stresses are calculated as nominal values; if large strains occur the actual stresses are much higher than initially calculated. Secondly, service performance must be some compromise between deformation and actual failure with due allowance for safety factors. For example, Fig. 6 indicates that 2-in. Schedule 80 PVC pipe under pure tension ruptured in about 250 hr. at a stress of 5,675 p.s.i. However, by referring to Fig. 4, it is seen that this pipe exhibited over 2% axial strain in a time of about 1 hr. For this case the pipe would be considered unusable after an hour, although actual failure did not occur until hundreds of hours later. Naturally, one would not design a PVC pipe to support a service load of 5675 p.s.i. In design it is necessary to ascertain which type of failure will occur first—rupture or excessive deformation.

Design example

For a system having a large number of equal spans the maximum bending moment is WL/12.

(*To page* 202)

Plastics Digest

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General

Recent advances in polymer technology. S. H. Pinner and A. Charlesby. Nature *181*, 1303-05 (May 10, 1958). Recent advances in polymer technology were presented at a conference in London by a group of experts. Abstracts of these talks are presented. The topics include methods of modifying physical arrangement, the rubberlike state, chemical reactions induced by polymer deformation, radiation effects, foamed materials, masterbatching, and resorcinol polycondensates in rubber.

New processes and technology. R. A. Labine and C. C. Van Soye. Chem. Eng. *65*, 125-38 (May 5, 1958). The significant technical developments in the chemical process industries, including plastics, for the period starting with July 1956 are presented in tabular form. The product, use, and features of each process are listed and briefly described.

Materials

Graft copolymers—a new technology? D. J. Metz. Nucleonics *16*, 73-77 (Apr. 1958). The mechanisms and effects produced by graft copolymerization produced by radiation are reviewed. The properties of a number of plastics graft copolymers are described.

Teflon resin easier to extrude; available as film and powder. R. S. Mallouk and W. B. Thompson. Materials in Design Eng. *47*, 171, 173-4, 176 (Apr. 1958). A Teflon resin, produced by polymerizing tetrafluoroethylene and hexafluoropropene, softens at about 545° F. and is readily extruded at temperatures of 650 to 740° F. Its low melt viscosity permits the melt extrusion of wire coatings, rod, and tubing, the blowing of bottles, and rapid heat sealing. The new material has properties very similar to conventional Teflon. It has good electrical properties over a wide range of temperatures and frequencies; it is capable of resisting temperatures of 400° F. and higher for long periods of time; it remains tough over a temperature range of −300 to +400° F.; and it resists most chemicals. Its properties are attributed to the completely fluorinated structure. Fabrication techniques are discussed.

Further developments in the "Vulkollan" field. E. Müller. Rubber and Plastics Age *39*, 195, 197, 199-200, 203, 205 (Mar. 1958). The chemical compositions of various polyurethanes of the elastomeric and plastics type are disclosed. Products made by the reactions of the isocyanates with water, polyalcohols, diamines, polyesters, and polyethers are described. Effects of variations in the relative amounts of reactants are considered.

Some n-disubstituted amides of long-chain fatty acids as vinyl plasticizers. F. C. Magne, R. R. Mod, and E. L. Skau. Ind. Eng. Chem. *50*, 617-18 (Apr. 1958). N-Disubstituted amides of the major individual and mixed component acids of cottonseed and peanut oils were prepared and subjected to a preliminary screening evaluation as primary plasticizers for vinyl resins. The morpholide of oleic acid, the unsaturated fraction of selectively hydrogenated cottonseed or peanut fatty acids, and the partially epoxidized morpholide of the unsaturated fraction of cottonseed acids were found to exhibit excellent plasticizer characteristics, tempered to a degree by their questionable thermal stability. Equally satisfactory morpholide plasticizers can also be obtained from many other vegetable, animal, and fish oils by application of the principles and treatments described.

Recent developments in the use of rigid low-density materials in plastics structures. D. S. Mahon. Plastics Inst. Trans. *26*, 69-79 (Jan. 1958). The properties and types of low-density core materials used in sandwich constructions are reviewed.

Cellulose acetate outlook: bright or bleak? Chem. Week *82*, 47-48, 50 (Mar. 15, 1958). Production of cellulose ester plastics is presented. Uses in textiles and plastics are reviewed. It appears that textile types will decline in volume and plastics types will undergo a slow growth.

Polyethylene sires a rugged new hybrid. Chem. Week *82*, 69-70, 72 (Apr. 12, 1958). A crosslinked polyethylene-carbon black plastic is described in which the crosslinking is done chemically with dicumyl peroxide. The heat resistance and toughness are increased.

Organic fluorine rubbers. J. C. Tatlow. Rubber and Plastics Age *39*, 33-6 (Jan. 1958). Recent developments in the field of fluorine polymers are reviewed. Fluorinated olefins, aromatics, carboxylic acids, esters, amines, alcohols, ethers, organosulfur compounds, acrylate polymers, hydrocarbon polymers, polyesters, and silicones are described. 40 references.

Polyethylene: Preparation, structure, and properties. S. L. Aggarwal and O. J. Sweeting. Chem. Rev. *57*, 665-742 (Aug. 1957). The literature on the synthesis, structure, and properties of polyethylene is reviewed. The topics considered are polymerization, crystal and molecular structure,

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optical properties, orientation in films, solubility, fractionation, molecular dimensions, rheological properties, degradation, and relation of structure to properties. 560 references.

Preparation and properties of the alkylene carbonates. W. J. Peppel. Ind. Eng. Chem. *50*, 767-70 (May 1958). The alkylene carbonates are highly polar solvents and are particularly useful for obtaining solutions of organic polymers.

Molding and fabricating

Recent developments in the extrusion of plastics. G. L. Bata. Canadian J. Chem. Eng. 35, 159-64 (Dec. 1957). The present state of knowledge of the operating variables affecting the extrusion of plastics is reviewed. An operating diagram of practical utility is described and its use is recommended in connection with everyday problems in an extruding plant. The question of controlling quality is dealt with and methods for improving quality are suggested. 38 references.

Metal inserts for plastic molding. Prod. Eng. (Design Ed.) *29*, 104-105 (Apr. 28, 1958). Four types of metal inserts used in plastic moldings to meet design requirements are described by means of diagrams. They include inserts cut from round stock, cold-headed inserts, machined inserts, and sheet metal flat or formed inserts.

Marking materials for rubber, plastic films and coated fabrics. H. N. Vosmer. Wright Air Development Center Technical Report 57-296 (Feb. 1958). A standard procedure for marking ink evaluation was developed. Six inks from commercial sources were found to be acceptable for use as marking inks on the majority of coated fabrics and plastic films. Four inks were developed. Two of these are based on acrylic resins, and two on a polyvinyl butyral resin system. None of the ten inks recommended is entirely satisfactory for use on polyethylene or cotton-vinyl chloride plastic coated fabrics because they fail the adhesion and immersion tests. Titanium adhesion promoters were investigated but were found to contribute little toward the improvement of adhesion on the plastic films and coated fabrics. Work with treated polyethylene indicated a slight increase of adhesion over the untreated material. Printing on polyethylene still remains a serious problem. The inks developed and evaluated in this report are not satisfactory on this material.

Fabricating fiber glass mat reinforced plastics. G. Bomberg. Part I. Insulation *4*, 14-8 (Apr.); Part II. ibid. 9-14 (May 1958). Directions, suggestions and hints about the proper or recommended tools and procedures for various machining operations on fibrous glass reinforced plastics are presented. Among the operations included are: die design; punching; stamping; shearing; circular, band, hand, and jig sawing; drilling; countersinking; tapping; reaming; milling; routing; grinding; and many others. Safety and health considerations are included.

Designer's guide to honeycomb-sandwich structures. A. Marshall. Machine Design *30*, 126-35 (May 15, 1958). The core materials, facing materials, and adhesives used in making honeycomb sandwich constructions are described. Methods of making parallel surfaces, contoured surfaces, joining and connecting cores, skin attachments, and fasteners are reviewed.

Applications

Polyethylene-wax coatings. G. S. Peacock, W. H. McKnight, and J. M. Austin. Modern Packaging *31*, 137-42 (Jan. 1958). Certain specialized requirements in paper coatings may be obtained by the use of low-density polyethylenes as modifiers for paraffin and microcrystalline waxes. Data are presented on some properties of polyethylene-wax blends, including cloud point, viscosity, tensile strength, gloss, and water vapor transmission. The effects of variations in composition on each of these properties was studied, and applied to processing conditions when the molten material is maintained at less than 190° F. and at approximately 212° F. Results indicate that the polyethylene modified waxes are generally better than the waxes alone as paper coatings. Cloud points were generally unaffected by the base wax, but varied with resin density, molecular weight, and resin concentration. Viscosity was a function of the base-wax viscosity, resin concentration and molecular weight. Tensile strength, gloss retention, and water vapor permeability rates were improved by the addition of polyethylene to the base waxes.

Torpedo launcher of reinforced plastics. Materials in Design Eng. *47*, 11 (Apr. 1958). A torpedo launching assembly consisting of three tubes, made entirely of glass - mat reinforced polyester resin, plus hardware and electrical equipment is described. The basic tubes are centrifugally molded; the quadrants, adapters, covers, and other small parts are compression molded. Pressures of from 3000 to 5000 p.s.i. are developed within the tube. The entire assembly weighs 2000 lb. and would weigh about 4000 lb. if made of steel. It is resistant to corrosion, especially from salt water.

Printed circuits in new telephone design. M. Farr. Electrical Manuf. *61*, 96-97, 310, 312 (Apr. 1958). A new British telephone, claimed to be the first to use a printed circuit, is described. The main instrument case is molded from impact-resistant polystyrene, free from inserts, and mounted on a mild steel baseplate. Most of the instrument components are mounted on the printed-circuit plate. The handset is also molded from impact-resistant polystyrene and the handset cord consists of a tinsel conductor coated with PVC insulation.

Glass-reinforced epoxy springs offer strength, energy absorption. Materials in Design Eng. *47*, 12, 196 (Feb. 1958). Glass-reinforced epoxy cantilever-type leaf springs for use on vibrating conveyors are described. These springs were found to be superior in this application to steel (modulus of

elasticity too low), phenolic-impregnated plywood (poor moisture resistance), and glass-reinforced polyester (poor strength).

Plastic pipe in the chemical process industry. R. B. Seymour. Plastics Tech. *4*, 46-50, 59-60 (Jan. 1958). The present status of plastic pipe used in chemical processing equipment to eliminate corrosion is reviewed.

Special coatings will resist spillage. R. Cushing. Chem. Eng. *65* 156, 158, 159 (Feb. 24, 1958). Thirteen coating systems for resistance to acids, alkalis, and solvents are recommended. Steel panels, both oxidized and non-oxidized, were coated with the various coating systems and exposed to 17 common chemicals. The number of repeated exposures required to damage the coatings was used to develop a rating system for the coatings tested. Techniques of applying protective coatings are given.

How to select best plastic for tanks. W. Reybold. Chem. Eng. *65*, 152, 154, 156 (Mar. 24, 1958). A plastic tank, designed for a specific chemical service, will in most cases cost less and last longer than a stainless steel tank. In the case of storing dilute sulfuric acid, polyvinyl chloride, polyester-glass, filled-phenolic resin, and poly-tetrafluoroethylene are all suitable. As most plastic materials lose tensile strength very rapidly above a certain temperature, it is essential to know not only the temperature the material will withstand, but also the maximum safe operating temperature. Plastics may be permanently deformed under loading conditions well within the safe limits predicted from short-time ultimate strength figures. Data on allowable loads are very limited. Glass-reinforced polyesters provide a wide range of strength and corrosion resistance. Used in large tank trucks, several thousand pounds of weight can be saved. Filled phenolic and furan plastic vessels are considered to be the workhorses of the chemical industry. In larger vessels they may require reinforcing. Polyvinyl chloride has excellent resistance to most acids and is used as a self-supporting material in smaller tanks. Tank design is also discussed.

Properties

Toxicity of plastics. Brit. Plastics *31*, 115 (Mar. 1958). A summary is given of the newly released report by the Toxicity Subcommittee of the British Plastics Federation. This report is designed to supply basic requirements for voluntary standards in the production of plastics food packaging materials. Some of the procedures for determining the extractibility of plasticizers, lubricants, and stabilizers are briefly discussed. General methods for the determination of toxicity levels are presented.

Effect of temperature on industrial plastic laminates. N. A. Skow. Materials in Design Eng. *47*, 109-11 (Feb. 1958). Graphs showing the flexural strength, impact strength, insulation resistance, and power factor as a function of temperature are given for phenolic, melamine, silicone, and epoxy resins reinforced with paper, glass cloth, cotton fabric, or nylon fabric. For the temperature range —100° to 200° F., flexural strength values for all nine laminates tested are relatively unaffected by temperature. Impact strength values for the paper and cloth-base laminates tend to remain the same or increase slightly as the temperature increases. Glass-base materials show an improvement in impact strength at lower temperatures.

Friction and abrasion characteristics of plastic materials. M. A. Marcucci. SPE J. *14*, 30-33 (Feb. 1958). An abrasion device was developed for use in the measurement of frictional properties and the abrasion resistance of plastics. The equipment was designed for use at high loadings and rates of speed over extended periods of test. Abrasion was obtained by placing hardened beryllium copper riders in contact with the surface of the specimen. The riders were mounted on three concentric rings, each of which was independently loaded through an arm assembly. Frictional force was obtained by measuring tangential force, on the arm assembly, with a dynamometer. Recording equipment connected to the dynamometer and to thermocouples in the ring mounts provided a means of obtaining continuous force and temperature measurements. Tests were conducted by rotating a 4-in.-diameter disc at 100 revolutions per minute for 7 hr. using normal forces of 250 to 300 p.s.i. on the beryllium copper riders. Coefficients of friction were obtained for a variety of thermoplastic and thermosetting materials. Considerable and sometimes unusual differences were obtained between the materials, with regard to their frictional and abrasive characteristics. The results indicated that this test method was much more effective for the evaluation of plastics materials for long-time service in the presence of frictional forces and abrasive materials, than some of the test methods presently in use.

Testing

Plastics for abrasion resistance. J. P. Abbat. Product Eng. *29*, 105-07 (Mar. 31, 1958). A 3-min. abrasion test for a rapid evaluation of plastics and elastomers is described. The specimen is loaded with 2 kg. and worn down on abrasive paper clamped to a drum revolving at 40 r.p.m. The specimen is pushed once across the drum for a total length of travel of 160 feet. Variation in abrasive paper is determined with a standard rubber. A table of plastic and elastomeric materials which are evaluated for abrasion resistance, tensile strength, elongation, tear resistance, oil resistance, and service temperature is presented in this article.

The determination of plasticizer volatility in PVC compounds. L. Rössig. Kunststoffe *48*, German Plastics Digest Section, p. 8 (Jan. 1958). The volatility of seven plasticizers in polyvinyl chloride plastics was investigated. The Brabender apparatus has its merits for testing the pure plasticizer, but only as a means of obtaining comparative results. It is essential to test the plasticizer in compounded form. Plasticizer

loss at elevated temperatures is higher for polyvinyl chloride plastics than for plasticizer alone. The thickness of the sheeting is a vital factor as far as plasticizer volatility is concerned.

End-use correlation of styrene container testing. B. Nathanson. Plastics Tech. *4*, 433-38 (May 1958). Ball drop, chemical, moisture vapor transmission, and compression (tensile-fracture) tests were made on packaging containers made of polystyrene. The results correlate with behavior in service.

Chemistry

"Caged" accelerators. Chem. Eng. News *36*, 62, 64 (May 26, 1958). Catalysts are held in molecular sieves, compounded with rubbers or plastics, and then reacted to produce the end product. This technique makes possible the use of volatile or highly-reactive catalysts under easily controlled conditions.

Publishers' addresses

British Plastics: Lliffe and Sons, Ltd., Dorset House, Stamford St., London S.E. 1, England.
Canadian Journal Chem. Eng.: The Chemical Institute of Canada, 18 Rideau St., Ottawa 2, Ontario, Canada.
Chemical and Engineering News: American Chemical Society, 1155 Sixteenth St., N.W., Washington, D.C.
Chemical Engineering: McGraw-Hill Digest Publishing Co., Inc., 330 W. 42nd St., New York 36, N.Y.
Chemical Review: American Chemical Society, 1155 Sixteenth St., Washington 6, D.C.
Chemical Week: McGraw-Hill Publishing Co., Inc., 330 W. 42nd St., New York 36, N.Y.
Electrical Manufacturing: The Gage Publishing Co., 1250 Sixth Ave., New York, N.Y.
Industrial and Engineering Chemistry: American Chemical Society, 1155 Sixteenth St., N.W., Washington 6, D.C.
Insulation: Lake Publishing Co., 718 Western Ave., Lake Forest, Ill.
Kunststoffe: Karl Hanser Verlag, Leonhard-Eck-Strasse 7, Munich 27, Germany.
Machine Design: Penton Publishing Co., Penton Bldg., Cleveland 13, Ohio.
Materials in Design Engineering: Reinhold Publishing Corp., 430 Park Ave., New York 22, N.Y.
Modern Packaging: Breskin Publications, 575 Madison Ave., New York 22, N.Y.
Nature: Macmillan and Co., Ltd., St. Martin's St., London W.C. 2, England.
Nucleonics: McGraw-Hill Publishing Co., Inc., 330 W. 42nd St., New York 36, N.Y.
Plastics Institute Trans.: The Plastics Institute, 6 Mandeville Place, London W. 1, England.
Plastics Technology: Bill Brothers Publishing Corp., 386 Fourth Ave., New York 16, N.Y.
Product Engineering: McGraw-Hill Publishing Co., 330 W. 42nd St., New York 36, N.Y.
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SPE Journal: Society of Plastics Engineers, Inc., 513 Security Bank Bldg., Athens, Ohio.
Wright Air Development Center Technical Report: Office of Technical Services, Department of Commerce, Washington 25, D.C.

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U.S. Plastics Patents

Copies of these patents are available from the U.S. Patent Office, Washington, D.C., at 25¢ each.

Polymers. W. Muuch, C. Maderno, L. Notarbotolo, and R. Lamma (to Perfogit). U. S. 2,829,127, Apr. 1. Ethylene polymers.

Resin. F. P. Greenspan and R. E. Light, Jr. (to Food Machinery). U. S. 2,829,130, Apr. 1. Epoxy resin.

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Resin. J. G. Shukys (to Air Reduction). U. S. 2,830,007, Apr. 8. Trifluoroethyl vinyl ether resin.

Resin. W. Fisch (to Ciba). U. S. 2,830,031, Apr. 8. Epoxy resin.

Resins. H. P. Siebel (to Badische Anilin). U. S. 2,830,032, Apr. 8. Cross-linked vinyl copolymers.

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Bottle. J. Pinsky, A. E. Adakonis, and A. R. Nielsen (to Plax). U. S. 2,830,721, Apr. 15. Coated polyethylene bottles.

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Irradiation. K. J. Mackenzie, Jr. (to General Electric). U. S. 2,830,943, Apr. 15. Controlling the irradiation of polyethylene.

Interpolymer. N. R. Peterson, W. A. Henson, and D. P. Churchfield (to Dow). U. S. 2,830,961, Apr. 15. Interpolymer of nuclear methylated styrenes.

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Plastic. L. W. A. Meyer and M. H. Broyles (to Eastman Kodak). U. S. 2,831,777, Apr. 22. Cellulose ester plastic.

Foam. A. S. Aase and L. L. Bolstad (to Minneapolis-Honeywell). U. S. 2,831,820, Apr. 22. Epoxy resin foam.

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Latex. B. H. Carr, D. C. Doane, and L. E. Lefevre (to Dow). U. S. 2,831,822, Apr. 22. Prolonging the film-forming life of a vinyl latex.

Plastisols. W. H. White (to U. S. Rubber). U. S. 2,831,824, Apr. 22. Vinyl chloride plastisols.

Polyethers. T. W. Campbell (to Du Pont). U. S. 2,831,825, Apr. 22. Polyethers of oxetanes.

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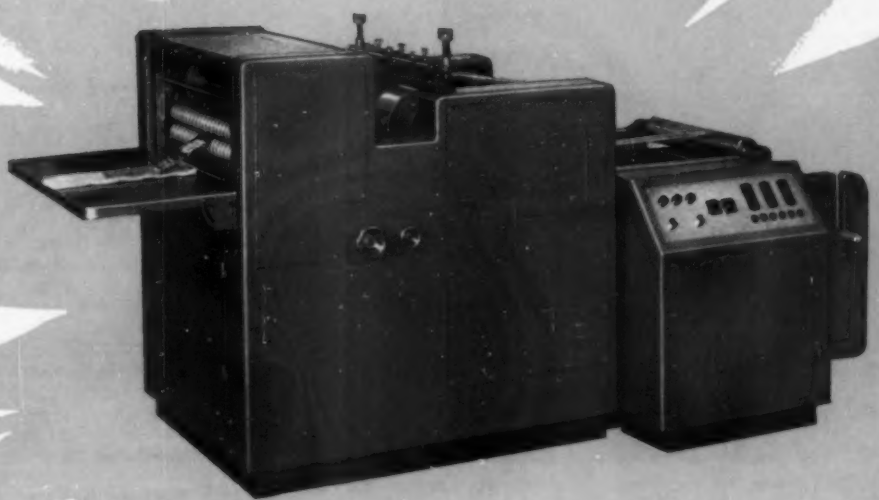

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Apr. 22. Polymerization of vinyl chloride.

Molding. F. A. Groth. U. S. 2,832,-094, Apr. 29. Machine for draw molding.

Mixing. C. L. Hornberger (to Armstrong Cork). U. S. 2,832,574, Apr. 29. Tumbler for mixing plastic composition.

Antistatic treatment. W. E. Walles (to Dow). U. S. 2,832,696-7-8-9, Apr. 29. Applying antistatic agents to polyethylene.

Cellular plastics. E. C. Soule (to Olin Mathieson). U. S. 2,832,744, Apr. 29. Blowing agent for cellular plastics.

Blends. M. M. Safford and R. L. Myers (to General Electric). U. S. 2,832,748, Apr. 29. Polyethylene-polybutadiene blends.

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Resins. S. J. Nelson, J. S. Sconce, and P. Robitschek (to Hooker). U. S. 2,833,681, May 6. Epoxy resins cured with a fluorine-containing anhydride.

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Cellular plastic. E. Barthel, Jr. (to Du Pont). U. S. 2,833,730, May 6. Arylene diisocyanate fatty acid triglyceride-polyol cellular material.

Foams. D. E. Weyer (to Dow Corn-

ing). U. S. 2,833,732, May 6. Siloxane resin foams.

Interpolymers. J. A. Cottrell and D. H. Hewitt (to Sherwin-Williams). U. S. 2,833,733, May 6. Interpolymers of styrene.

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Textile treatments. S. Nitszche and E. Pirson (to Wacker Chemie). U. S. 2,833,735, May 6. Organosiloxane resins.

Resin. J. Dazzi (to Monsanto). U. S. 2,833,739, May 6. Vinyl chloride polymer plasticizer.

Polymers. J. J. Verbank (to Du Pont). U. S. 2,833,740, May 6. Polyurethanes.

Polymerizing. J. Lal (to H. D. Justi). U. S. 2,833,741, May 6. Polymerizing acrylate esters.

Elastomers. R. J. Koch (to Dow Corning). U. S. 2,833,742, May 6. Room temperature-curing siloxane elastomers.

Resins. R. H. Reinhard (to Monsanto). U. S. 2,833,743, May 6. Polycyanohydrins.

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Resins. F. P. Greenspan and R. E. Light, Jr. (to Food Machinery). U. S. 2,833,747, May 6. Epoxidized hydrocarbon resins.

Copolymers. H. K. Wiese and W. C. Smith (to Esso). U. S. 2,833,748, May 6. Solid copolymer of cyclodienyl trichlorosilane.

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Polyolefins. H. W. Coover, Jr. (to Eastman Kodak). U. S. 2,833,755, May 6. Polymerization of olefins.

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Automatic forming machine

The Meteor Automatic drape and vacuum forming machine has an adjustable drape stroke to 15 in., infra-red heaters with controller, cooling fan, adjustable clamping frame, air-eject feature, cycle timer, and complete vacuum system. Activation of mechanism requires both hands of the operator. It is available in four models with maximum forming areas of 4.2, 7.5, 15, and 24 sq. ft. The specifications on the several models are listed below. Prices range from $1976 to $11,075, depending on size and automation. *Comet Industries, 9865 Franklin Ave., Franklin Park, Ill.*

Comet Meteor Automatic has an adjustable drape stroke to 15 inches

Clean-up agent for epoxies

Isoterge 1405 is a solvent-based detergent that is said to do an effective job of cleaning uncured epoxy and polyester resins from working surfaces. Not only will it take up these resins and others, but it is miscible with water. After Isoterge loosens the resin, the surface is flushed clean with water. A companion product, No. 1401, is effective in removing cured resin wastes. Price: $6/gal. in 5-gal. cans. *Isochem Resins Corp., 221 Oak St., Providence 9, R.I.*

High-rate tester

The Model 625B testing machine can pull specimens at any rate from 2 to 8000 in./min., makes a 4- by 5-in load/strain record, has a dual-beam oscillograph and a camera. An electronic timer puts milli-, centi-, or deci-sec. time pulses on oscillograph record. Loading section and recording section are separate pieces, may be up to 50 ft. apart. Load ranges are from 0 to 20 lb., up to 0 to 5000 lb., with others available on special order. Accuracy is 2% of full-scale range. *Allegany Instrument Co., Inc., 1091 Wills Mountain, Cumberland, Md.*

Auxiliary injection equipment

The M-5 is an improved scrap grinder with a one-foot-square throat and 180° screen. The large-area screen is said to raise the output of this grinder 25 percent. It is fitted with two stationary knives and three rotating knives that are fully supported by the rotor, and have a 1-in. overhang. With a standard 5-hp. drive, price is $1450. An extra-heavy-duty model with double-end 7.5-hp. drive and heavier built throughout, is priced at $3450.

Refrigerated-water circulators, available in three new models, operate over temperatures from −20° to +90° F. Prices range from $1945 to $3645 for models suitable for molds on from 2- to 6-oz. machines to 12- to 24-oz. molders. A convection-type cooler, the Scotsman, using a closed-circuit water system, has a built-in radiator and fan that will cool mold-discharge water to within 10° F. of the ambient air temperature. The cooling unit is available separately or with a circulator. Complete set-up costs $922.50. *Injection Molders Supply Co., 3514 Lee Rd., Cleveland 20, Ohio.*

High-pressure extruder

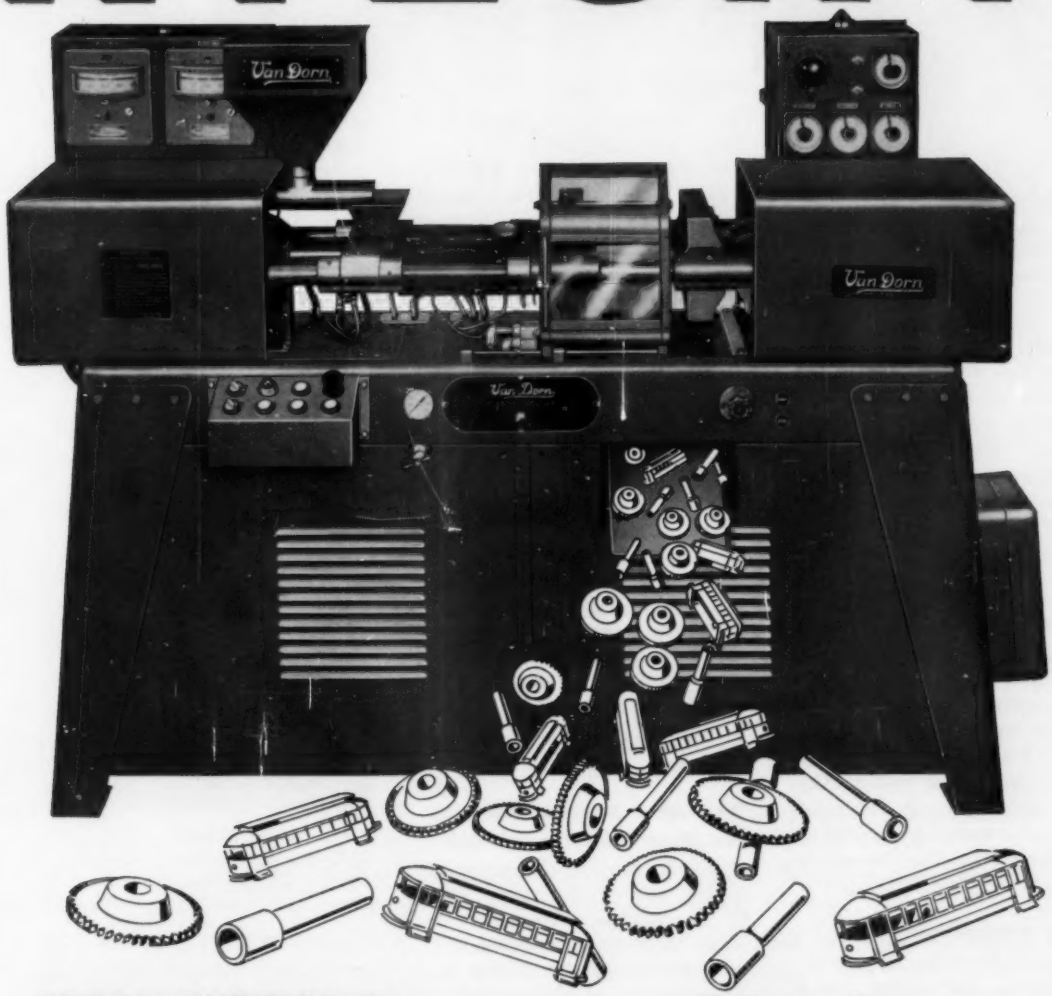
Capable of operating at 10,000 p.s.i. head pressure, the J.M.C. extruder has a control valve in the head. Available in 1.5-, 2.5-, 3.5-, and 6-in. screw diameters, the extruders are built with an L/D ratio of 21. Radial and thrust bearings are of spherical roller type, for heavy duty. Xaloy-lined cylinder and hardened screw flights make for long life. The head, which is fitted with a ther-

Specifications for Meteor Automatic

Model	*M-2030*	*M-3036*	*M-3660*	*M-4872*
Mold area (max.), in.	20 by 30	30 by 36	36 by 60	48 by 72
Height (oven lowered), in.	48	58	58	65
Floor area, in.	42 by 58	48 by 89	72 by 90	86 by 110
Air at 80 p.s.i., cu. ft. per operation	0.5	0.5	1.0	2.0
Amperage	22.8	36.	62.	85.
60-cycle AC source, v./phase	220/1	220/3	220/3	220/3 or 440
Drape stroke, in.	15	15	15	15
Lift force, lb.	720	720	1300	3000
Timer range, sec.	0-120	0-120	0-120	0-120
Vacuum pump, cu. ft./min.	9	9	25	40

*Specifications, claims made, and prices appearing in these pages are those of the manufacturers or sellers of the machinery and equipment described, or their agents. Prices are deemed to be F.O.B. sellers' plants (unless otherwise stated), are for "standard" models and are subject to change without notice. The publishers and editors of MODERN PLASTICS do not warrant and do not assume any responsibility whatsoever for the correctness of the same, or otherwise.

NYLON?



VAN DORN Presses mold it better

because–

1. Better material control
2. Close tolerances easier to maintain
3. Lower mold investment
4. Less waste in purging
5. Automatic cycling

Many additional outstanding features of Van Dorn Presses are described in literature available on request.

J.M.C. high-pressure extruder has a control valve in the head

mocouple that measures melt temperature, is available in several different constructions. Drive is selected to customer's needs and specifications. Speed reducer uses herringbone gears. Normal method of heating is with resistance heaters, but induction heating is available. *J.M.C., 683 Frelinghuysen Ave., Newark, N. J.*

Two-way panel saw

A panel saw that will cut stock up to 5 ft. wide is a larger version of a previous model. Saw will cross-cut and rip without operator having to reposition sheet being cut. Horizontal and vertical scales make possible accurate repetition of special cuts. *Richard C. Bennett Mfg. Co., Laceyville, Pa.*

Premix compounder

The Speed Densifier is a device for kneading and mixing, and is useful in the premixing of phenolic compounds, for example. Cost of processing is said to be only 1.5¢/lb. at rates up to 1000 lb./hr. No external heaters are required, mixing cycles are short. *Beardsley & Piper, Div. Pettibone Mulliken Corp., 2424 N. Cicero Ave., Chicago 39, Ill.*

Beardsley & Piper premix compounder does not require external heater

Roll-leaf stamper

The Kensol 15T is an air-operated press that will produce good roll-leaf stampings on a production basis. Features include adjustable electric dwell timer, thermostatic heat control, air-controlling unit, noise mufflers, and two-hand safety switches. The impression area is 2 by 4 in., and the 4-in. air cylinder powers a 2-in. head stroke. *Olsenmark Corp., 124 White St., New York 13, N. Y.*

Electronic heat sealer

A compact, simple electronic sealing unit, the Weldotron has a rated output of 500 watts and is pedal operated. Seals up to 12 in. long are possible. Depth of throat is 10.5 in., working daylight is about 2 inches. Controls include a timer, wattmeter, line breaker, and power control. Price: $490. *Plastic Welding Corp., 780 Frelinghuysen Ave., Newark 12, N. J.*

Wire-mesh heating elements

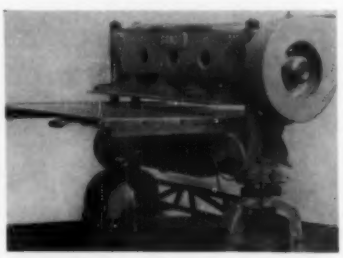
The Electrofilm line of heating elements are based on woven screen conductive paths. While the longitudinal wires carry the load, the crosswires guarantee uniform current distribution, even if several wires are accidentally broken. Several types are available: in one the mesh is laminated between layers of glass cloth and may be bonded to the surfaces to be heated. In another, it is enclosed between rubber tape or sheet to make flexible tape or blankets. A variety of rubbers are available as covering surfaces. In a third type, also flexible, the wires are covered with a ceramic-fiber cloth. Operating temperatures range up to 2000° F., depending on type and covering. A typical rubber-covered tape for 500° F. operation offers a watt density of 10 w./sq.in. Dimensions of tapes range from ¼ to 2 in. width, in any lengths, with resistances of from 1100 down to 0.07 ohms/in. *Electrofilm, Inc., P. O. Box 106, N. Hollywood, Calif.*

Heat-transfer cement

Thermon is a cement having a high thermal conductivity, and so is useful in improving heat transfer to surfaces with which it is hard to achieve good contact. It is capable of withstanding temperatures up to 750° F. for long periods and can be safely cycled through large changes in temperature. While its chief utility is in the chemical processing industry, it has improved heating rates and lengthened life of heaters on extruders and injection machines. *Thermon Mfg. Co., P. O. Box 1961, Houston, Texas.*

Large-area die cutter

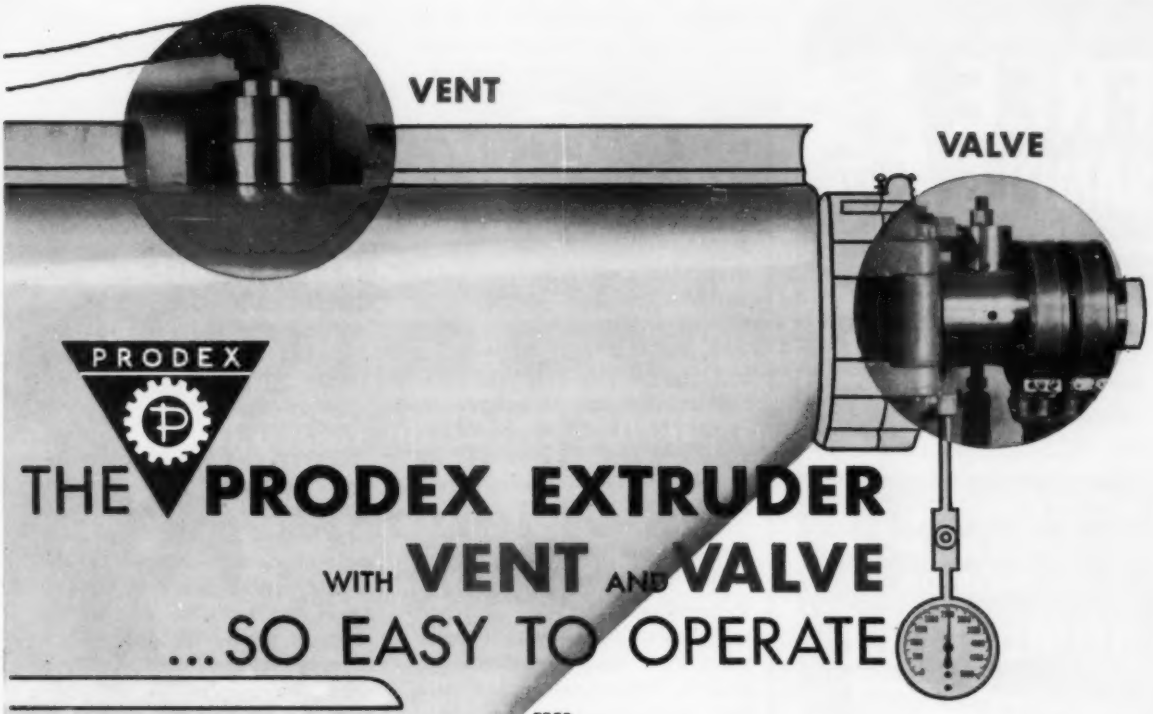
A heavy-duty die cutting machine, the Model ST 76-A is suitable for cutting and trimming large pieces formed from sheet, also for separating skin or blister packages from the sheet. Standard pressure plate is 60 by 24 in.; 60 by 34-in. size is available. Cutting stroke is 1 or 2 in., cutting force is 45 tons. Sliding table is ball-bearing mounted. Two-hand release prevents accidents. *Atlas-Sandt Corp., 240 W. 23rd St., New York 11, N. Y.*



Atlas-Sandt Model ST 76-A has cutting stroke of 1 to 2 in. and a cutting force of 45 tons

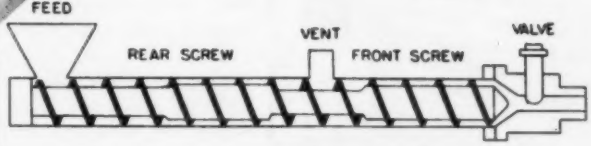
Thermal trimmer

The Therm-O-Trimmer trims vacuum-formed plastics pieces to a smooth edge by trimming with heat rather than a sharp edge. The method eliminates the need for large trimming forces, makes it possible to trim large perimeters with relatively light equipment. This trimmer is available in



PRODEX

THE PRODEX EXTRUDER WITH VENT AND VALVE ...SO EASY TO OPERATE



The combination of a TWO-STAGE extrusion screw with VENT and VALVE gives these advantages:

* **HIGH OUTPUT.** The rear screw determines the high output rate of this machine because it is not subjected to die back pressure. Easy valve adjustment permits the same output rate (lbs./hour) for a wide range of die openings.
* **CLOSE TOLERANCES.** Since the front screw is fed a hot melt of uniform viscosity, a constant pumping pressure is easily maintained by valving, resulting in close tolerances.
* **NO POROSITY.** Venting with or without vacuum continuously extracts air, moisture, monomer and other volatiles. High volatile content can be readily removed.
* **BETTER DISPERSION.** Two stage extrusion with intermediate relaxation and reorientation provides high intensity mixing. Valving permits controlled mixing in front screw.
* **DRY COLORING.** Dry colored compounds are directly extruded into shapes and sheets on PRODEX vented extruders.

PRODEX Vented Extruders are used successfully in sheet and shape extrusion of H.I. Styrene, ABS polymers and methyl-methacrylate without pre-drying; wire and cable coating and shape extrusion from vinyl dryblend as well as in a wide variety of process applications where monomer, solvents or moisture must be removed in large quantities.

No matter what thermoplastic material you now use, the PRODEX extruder will help you get better results. Arrange for a production-line demonstration today with your material.

50 PAGE ILLUSTRATED BULLETIN E-3 gives complete details about PRODEX EXTRUDERS.

Package installations for sheet, film, pipe, wire and cable, continuous compounding and laminating. PRODEX extruders are available in 1¾", 2½", 3½", 4½", 6" and 8" sizes.

PRODEX CORPORATION

FORDS, NEW JERSEY · Hillcrest 2-2800

Manufacturers of Process and Extrusion Machinery

IN CANADA: Barnett J. Danson & Associates, Ltd., 1912 Avenue Road, Toronto 17, Canada

PRODEX

standard bed sizes up to 62 by 45 in. (19.4 sq. ft.) with strokes from 4 to 12 inches. Larger beds are available on special order. Timing and temperature control are automatic. *Boston Cutting Die Co., 50 Freeport St., Boston 22, Mass.*

Dial micrometer

Especially designed for gaging thin films and foils, the Cady 10,000 micrometer consists of a cast base with a 4-in. throat, a spring-loaded anvil shaft, and can gage films up to 50 mils thick. Dial indicates ten-thousandths directly. Meets A.S.T.M. and TAPPI standards. *E. J. Cady & Co., 630 N. Harlem Ave., River Forest, Ill.*

Release for moldings to be decorated

ReleasaGen H-15-1, designed specifically for use with plastics parts that are to be decorated, permits decorating without further preparation. It has performed well with most thermoplastics, has a rust-inhibiting action that helps preserve molds. *General Mills, Inc., 2010 E. Hennepin Ave., Minneapolis 13, Minn.*

Extrusion-injection molder

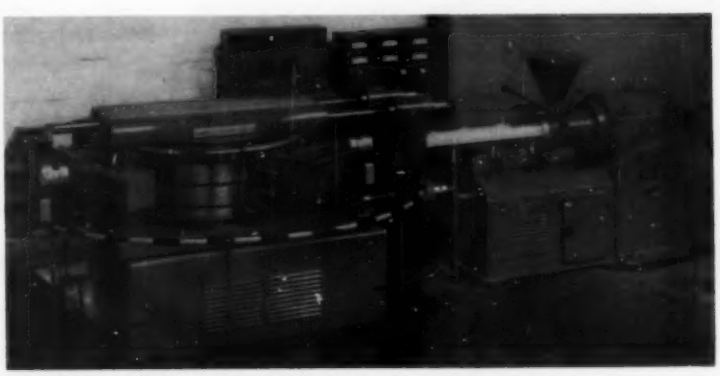
A molding machine called the Extr-a-formatic consists of an extruder combined with an automatic turntable on which are mounted several molds that are filled in rotation. This system takes the cooling time out of the cycle, also provides high plasticating capacity—up to 550 lb./hr. in present models. Pieces weighing from 4 oz. to 108 oz. can be "efficiently" molded. Two sizes of extruders are offered with the machine—3.6 in. and 4.8 in. in diameter. Injection pressure is about 4000 p.s.i., clamping force is 550 tons, maximum depth of molding is about 19 in., and the largest mold dimensions are 15.7 by 19.7 in. Mold opening and closing are accomplished by moving the entire turntable away from and toward the extruder. This German-made machine is sold in the U. S. by *Continental Machinery Co., Inc., 261 Broadway, New York 7, N. Y.*

Flexographic press

This press has a central impression cylinder and can print even the most delicate materials, such as unbacked foil. The four printing stations are equipped for the Anilox method. Large intercolor driers are built in, but can be removed easily. All controls for running register are on operator's side. The machine is equipped with one rotogravure station for in-register lacquering and coating. A drying tunnel is heated by air from gas-fired heater. Web widths up to 72 in. can be handled on some models at 400 ft./min. *The Inta-Roto Machine Co., P. O. Box 454, Byrd Airport, Richmond, Va.*

Portable tester

The Quick-Test is a portable strength testing machine that can develop over 160,000 p.s.i. on ¼-in.-diameter test specimens. The basic measuring instrument is offered with accessories for making shear, transverse bending, tensile, and compression tests. In operation, force is applied with a



Paul Troester Maschinenfabrik Extr-a-formatic consists of an extruder combined with an automatic turntable

Tensile test is in progress on QuickTest instrument

handwheel and the reaction on a pressure plate develops hydraulic pressure that is registered on a large Bourdon gage. The basic instrument weighs only 47 pounds. Price of the instrument is $420; with all necessary attachments: $757.50. *Truck Scale & Research Corp., P. O. Box 1047, St. Petersburg, Fla.*

Big scrap grinder

A scrap grinder capable of reducing chunks 11 in. thick to small particles, called the "Hog" is a handy tool in shops where big extrusions are made. Production rates range from 2000 to 3000 p.p.h. A water-cooled jacket around the cutting chamber prevents overheating, even on 24-hr. operation. The rotor is keyed to two extra-large flywheels, drive may be any horsepower up to 200. *Alsteele Engineering Works, Inc., 82 Herbert St., Framingham, Mass.*

Temperature controller

The Pyrotroller is a temperature controller that uses the current output of a thermocouple to indicate temperature and a simple electronic circuit to control heater input. Measuring components are essentially like those of the rugged Alnor portable pyrometers made by the same maker. Ten scale spans are available, from 400 to 3000° F. Double-setting (upper and lower target temperatures) models are available. Price: $155 for single-target models. *Illinois Testing Laboratories, Inc., 420 N. LaSalle St. Chicago 10, Ill.*

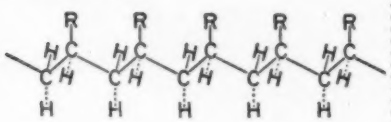
HERE'S THE STORY ABOUT **Moplen*** POLYPROPYLENE: New polymer of isotactic structure offers high softening point . . . excellent mechanical, thermal and electrical properties . . . easy processing.

CHEMICAL NATURE & STRUCTURE *(No. 1 in a series)*

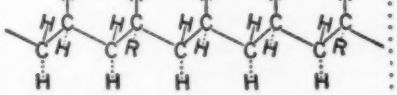
"MOPLEN" is the trademark of the polypropylene produced by Montecatini Soc. Gen. by stereospecific polymerization of propylene, an asymmetric olefin available in large amounts from both the petroleum and petro-chemical industries.

When propylene molecules join each other during polymerization, the resulting polymeric chains may, depending on the polymerization conditions, assume one or the other of the structures shown in the illustrations. Here (supposing the polymeric chain stretched on a plane) the dotted lines indicate bonds with atoms or groups lying below the plane, and the continuous lines indicate bonds with atoms or groups lying above the plane.

I. ISOTACTIC



II. ATACTIC



Using stereospecific catalysts discovered by Professor Giulio Natta of the Milan Polytechnic Institute, a structure (I) can be obtained which corresponds to the highest intramolecular order, and which is called "isotactic," that is, spatially ordered.

On the other hand, when chain formation occurs at random, the final product has a disordered structure, which is called "atactic" (II). In other words, depending on polymerization conditions, different macromolecular structures and therefore different characteristics of the polymer may be obtained. These can be adapted to different technological purposes.

*Montecatini Trademark

"MOPLEN"

Montecatini now produces in Italy the following types of "MOPLEN": M1, M2 and A2.

M 1 has a melt index of about 20, remarkable fluidity in the melted state, and is therefore particularly suitable for extruded films and blown moldings.

M 2 has a melt index of about 6, and is suitable for injection molding and the extrusions of pipes and shapes.

A 2 has a melt index of about 4, and is suitable for injection molding and extrusion. It is stiffer, harder, has higher resistance to heat than M 1 and is especially good for electrical applications.

It is expected that in the near future Montecatini will be able to offer other types of "MOPLEN." Their different molecular weights and technological characteristics will enable them to fulfill the widest possible requirements of the market.

For more detailed information about "MOPLEN" please write, outlining area of interest, to

Chemore Corporation
General Representative in U.S.A. & Canada for Montecatini
21 West Street, New York 6, N. Y.

Typical physical properties of MOPLEN M2 and A2

PROPERTIES	TEST METHOD	UNITS	RANGE OF VALUES
PHYSICAL AND MECHANICAL			
Specific gravity	ASTM D792–50	kg/liter	0.90–0.91
Apparent density (granular form)	" D392–38	kg/liter	0.40
Bulk factor	" D1182–54	—	2.25
Yield strength	" D638–52T	kg/cm² / lbs/in²	300–350 / 4,300–5,000
Ultimate tensile strength (.2"/min.)	" D638–52T	kg/cm² / lbs/in²	300–380 / 4,300–5,400
Elongation (yield point)	" D638–52T	%	10–20
Total elongation	" D638–52T	%	500–700
Compressive strength	" D695–54	kg/cm² / lbs/in²	600–700 / 8,500–10,000
Stiffness (flexural)	" D747–50	kg/cm² / lbs/in²	8,500–13,000 / 120,000–186,000
Hardness, Rockwell	" D785–51	R-scale	85–105
Impact strength, Izod test, ½" x ½" unnotched bar	" D256–54T	kg/cm/cm² / ft. lb/in	80 / 19
Young's modulus	ultrasonic	dyn./cm²	$3.0–3.6\times10^{10}$
Water absorption	ASTM D570–54T	% weight increase	nil
ELECTRICAL			
Dielectric constant (10^6 cycles/sec.)	ASTM D150–54T	—	2.0–2.1
Dissipation factor (10^6 cycles/sec.)	" D150–54T	—	.0002–.0003
Dielectric strength	" D149–55T	kV/mm / V/mil	30–32 / 750–800
Volume resistivity	" D257–54T	Ohm • cm	10^{16}
THERMAL			
Melt index†	ASTM D1238–52T	g/10 min.	4–6
Thermal conductivity	—	cal/cm/cm²/sec./°C / B.T.U./in/ft²/hr/°F	2.1×10^{-4} / .73
Specific heat	—	K cal/g./°C	0.46
Coefficient of thermal expansion	ASTM D696–44	cm/cm/°C / in/in/°F	110×10^{-6} / 61×10^{-6}
Deformation under load‡	—	%	<10 at 135°C
Softening point (Vicat–1 kg.)	DIN 57302	°C / °F	>140 / >284
" " (Vicat–5 kg.)	" "	°C / °F	>85 / >185
1st order transition temperature	crystallographic microscope	°C / °F	164–170 / 329–338
2nd order transition temperature	specific volume test	°C / °F	−35 / −31
Resistance to heat when not subject to strain	—	°C / °F	150 / 302

† Method modified by using 10 Kg. load instead of 2.16 Kg.
‡ Under tension of 15 Kg/cm² (210 lbs/in²) by increasing temperature at the rate of 50°C/hr. (90°F/hr.)

MONTECATINI
SOC. GEN. • MILANO, ITALY

U. S. Representative: CHEMORE CORPORATION • 21 WEST STREET, NEW YORK 6, N. Y. • HANOVER 2-5275

Books & Booklets

Write for these publications to the companies listed. Unless otherwise specified, they will be sent gratis to executives who request them on business stationery.

"British Plastics Year Book 1958: A Classified Guide to the Plastics Industry. 28th Edition"

Published in 1958 by Iliffe & Sons, Ltd., Dorset House, Stamford St., London S. E. 1, England. 816 pages. Price: 43s. 9d. $6.00.

Included in this annual book are: review of recent patents; list of new companies registered in 1957; specifications relating to plastics; guide to plastics material suppliers; guide to plastics product manufacturers and plastics processors; guide to equipment suppliers and services; glossary of trade and technical terms; names and addresses of plastics firms grouped by countries, also of organizations, consultants, etc.; Who's Who in the British plastics industry; set of tables giving comparative properties of plastics materials; and technical and general data.

"Linear Polyethylene and Polypropylene"

Published in 1958 by Polymer Assocs., 6613 Wenonga Rd., Kansas City, Mo. 200 pages. Price: $13.50

This comprehensive report on the rapidly-expanding (and complicated) field of high-density polymers was prepared by graduate students of the Harvard Business School. It presents a concise breakdown of the chemistry of the high-density polymers, property comparisons with other plastics, advantages and disadvantages, and a market study of future trends and uses for the new materials. Of outstanding interest are the chapters analyzing the problems and opportunities these materials present to molders, extruders, and fabricators. A compilation of the present position, current problems, and future plans of resin manufacturers in the U. S. and abroad, a review of application possibilities, a chapter on manufacturer-fabricator relationships, and a glossary of terms completes the report.

Multi-hole tubes. Dimensions, applications, available styles, samples, etc., multi-hole pressure and connector tubes. These flexible vinyl tubes, extruded in tape-like form, can replace unwieldy bundles of loose, individual tubes wherever there is a need for compactness and better organization of connecting lines. Form #106. 4 pages. *Jessall Plastics, Kensington, Conn.*

Plastic odorants. Technical data on concentrated odorants, Thermoscents, emulsified and solubilized odorants, technical considerations, sources of malodor, methods of masking, etc. 12 pages. *Fritzsche Bros., Inc., Port Authority Bldg., 76 Ninth St., New York 11, N. Y.*

Plastisols. Technical data on Chem-O-Sol coating and molding compounds. Bulletin 144. 16 pages. *Chemical Products Corp., King Philip Rd., E. Providence, R. I.*

Polymeric materials. Five reports of research on polymeric materials for the Armed Forces. "Bulk Compressibility of Polymers at Fabricating Temperatures." Report PB 131334. 25 pages. Price: 75 cents. "The Branching Reaction in Polymerization of Styrene and Methyl Methacrylate." Report PB 131094. 62 pages. Price: $1.75. "Preparation and Characterization of a Series of Graft Copolymers." Report PB 131333. 21 pages. Price: 75 cents. "The Oxidative Degradation of Large Molecules." Report PB 131384. 43 pages. Price: $1.25. "Oxidative Degradation of Deutero-Polystyrenes." Report PB 131409. 45 pages. Price: $1.25. *OTS, U.S. Department of Commerce, Washington 25, D.C.*

Acrylic rods, tubes, and shapes. Illustrates uses for extrusions and lists various sizes and shapes of acrylic rods, tubes, and shapes available. 2 pages. *Ace Plastics Co., 91-30 Van Wyck Expressway, Jamaica 35, N. Y.*

Plastics for electronics. Materials available for electronics uses, including casting resins, foams, rods and sheets, surface coatings, adhesives and sealants, impregnating resins, and laminating resins. 4 pages. *Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.*

Clay fillers. "Hydrophobic, Organophilic Surface Modified ASP Products 03 and 05 Series as Extender Pigments and Conditioning Agents." Summary of research on clay fillers used in plastics, paints, and inks. TI 1026. 21 pages. *Minerals & Chemicals Corp. of America, Menlo Park, N. J.*

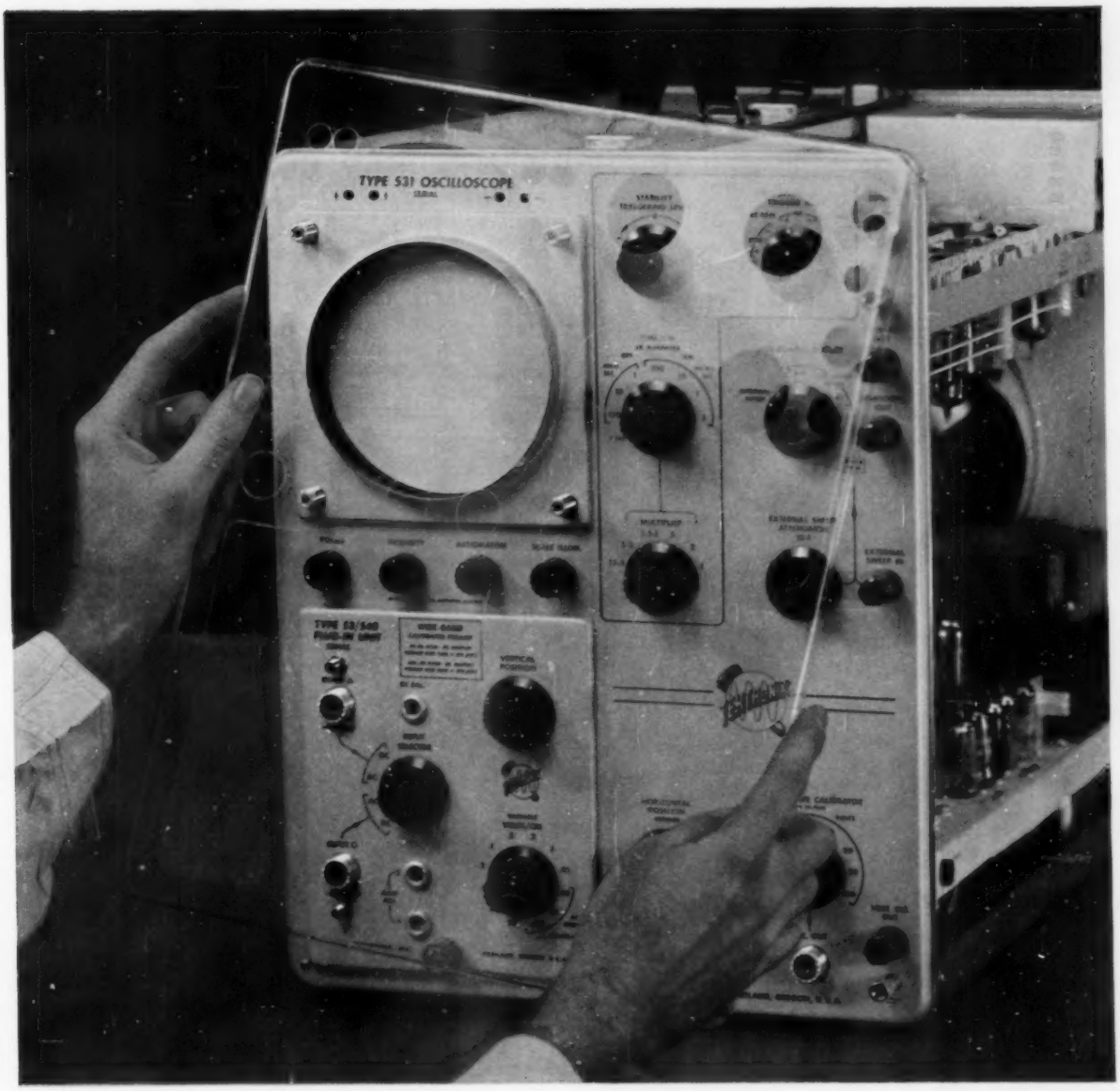
Thermoplastic materials. Services and facilities available, plus a properties chart for Plexiglas, nylon, Teflon, Kel-F, Rexolite, polyethylene, polystyrene, Vinylite, and acetate. 4 pages. *Comco Plastics, Inc., 97-24 Albert Rd., Ozone Park 17, N. Y.*

Casting compounds. "Hysol 'Systems Selector' for Electrical Casting Compounds" describes 38 systems and includes a tabular listing of comparative properties. Bulletin ESS-1. 6 pages. *Houghton Laboratories, Inc., Olean, N. Y.*

Impregnating resins. Properties, curing conditions, and other technical data on epoxy and polyester impregnating resins. 48 pages. *Polyplastex United, Inc., 870 Springfield Rd., Union, N. J.*

Fibrous glass. "A Manual of Fiberglas Fabrication by Koch Fiberglas" shows the facilities,

How versatile **Kodapak Sheet** stands in to cut production costs!



HERE's an assembly-line idea that's speeding production, cutting costs for Tektronix, Inc. (Portland, Ore.). Special 20-gauge Kodapak Sheet panels, vacuum-formed to fit, cover the face of each instrument during assembly. Tough, rigid, crystal-clear, this Kodapak "stand in" permits testing and adjustments. Same time, it saves costly dials and scales from disfiguring scratches and gouges. Result: final touch-up is minimized—costs, lower.

If more efficient production is your problem, it will pay you to look into this use of versatile Kodapak Sheet. Call our representative or write

Cellulose Products Division, EASTMAN KODAK COMPANY, Rochester 4, N. Y.

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products, services, etc. of this fabricator. 24 pages. *H. Koch & Sons, Corte Madera, Calif.*

Polyethylene. "Dry Colourants for Polythene" gives tumbling and mixing instructions, quantities available, etc. for both low- and high-density polyethylene. 4 pages. *Erinoid, Ltd., Stroud, Gloucestershire, England.*

Polyester resins. "Micro-Milled Color Paste Dispersions for Polyester Resins" shows 24 standard color paste dispersions available and includes characteristics of each. 6 pages. *Plastic Molders Supply Co., Inc., 74 South Ave., Fanwood, N. J.*

Extruder. Uses, properties, etc., of Indulin, an alkali lignin, used as a resin extender and for other applications. 20 pages. *Polychemicals Div., West Virginia Pulp & Paper Co., Charleston A, S. C.*

Nylon. Physical and mechanical properties, range of viscosities available, etc., for Spencer nylon. 30 pages. *Spencer Chemical Co., Dwight Bldg., Kansas City 5, Mo.*

Reinforcement. Abrasion resistance, electrical properties, flexibility, corrosion resistance, weight, and other technical data for Troytuf blanket for reinforced plastics. 14 pages. *Troy Blanket Mills, 200 Madison Ave., New York 16, N. Y.*

Production facilities. Services available to manufacturing industries, including production tools, engineering facilities, custom built machinery, etc. 12 pages. *Lawrence H. Cook, Inc., 65 Massasoit Ave., E. Providence 14, R. I.*

Adhesives. Descriptive information, properties, price lists, etc. of epoxy resin adhesives. 25 pages. *Armstrong Products Co., Argonne Rd., Warsaw, Ind.*

Decorative laminates. Preparation of decorative laminates from Dapon (diallyl phthalate) resin, which are moisture-proof, solvent-proof, and abrasion-resistant and can be applied directly on cores at low pressures. 13 pages. Technical Data No. 19. *Chemicals & Plastics Div., FMC Organic Chemicals Dept., Food Machinery & Chemical Corp., 161 E. 42nd St., New York 17, N. Y.*

Polyester resins. Types and uses, physical and chemical properties, dyes, pigments, fillers, etc., for Polylite polyester resins for laminating, molding, casting, encapsulating, and surfacing applications. 12 pages. *Reichhold Chemicals, Inc., RCI Bldg., White Plains, N. Y.*

Sheets, tubes, rods. Technical information, specifications, prices, etc., for plastics sheets, tubes, and rods. 146 pages. *Delta Products, P. O. Box 1440, Fort Worth 1, Texas.*

Government specifications. List of Borden chemical products recommended to comply with U. S. government specifications. 10 pages. *Borden Chemical Co., Government Services Dept., 350 Madison Ave., New York 17, N. Y.*

Granulators. Sizes, advantages, etc., for line of granulators. 2 pages. *Alsteele Engineering Works, Inc., 82A Herbert St., Framingham, Mass.*

Chlorine compounds. Properties, uses, shipping regulations, handling and storage, specifications, and test methods for 11 organic chlorine compounds available in commercial quantities. 46 pages. Booklet F-4769C. *Union Carbide Chemicals Co., 30 E. 42nd St., New York 17, N. Y.*

Fibrous glass greenhouses. Construction details and specification data. 8 pages. *Filon Plastics Corp., 2051 E. Maple Ave., El Segundo, Calif.*

Nylon. Technical data, outstanding features, applications, etc. for Nylatron "GS" (molybdenum disulphide) filled nylon parts. 4 pages. *National Polymer Products, Inc., Reading, Pa.*

Color trends. Chart showing American preference of colors for paints and wallpaper, automobiles, and home furnishings from 1933 and projected through 1960. 6 pages. *Faber Birren & Co., 500 Fifth Ave., New York 36, N. Y.*

Plastics, the Story of an Industry. History, development, branches, manufacturing processes, types of plastics and products, colleges and universities offering plastics courses, etc. 42 pages. Price: 1000 copies and over, 25¢ each; 500-999, 26¢ each; 50-499, 28¢ each; 10 to 49, 30¢ each. *The Society of the Plastics Industry, Inc., 250 Park Ave., New York 17, N. Y.*

Modern Marine Nylon. Data on deck fittings and other nylon boat accessories. 4 pages. *The Danielson Mfg. Co., Danielson, Conn.*

Fusion bond finishes. Technical data and applications for a line of Corvel cellulosic, nylon, polyethylene, K-51 (chlorinated polyether), and other new fusion bond finishes for cladding metal parts. 4 pages. *National Polymer Products, Inc., Reading, Pa.*

What SPE Can Do for You. Prospectus summarizes activities and benefits of the Society. 16 pages. *Society of Plastics Engineers, Inc., 34 E. Putnam Ave., Greenwich, Conn.*

Thickeners. Composition, properties, and preparation of solutions, nonaqueous solvents, plasticization, film compatibility, etc., of Methocel, a family of methylcellulose ethers used as thickeners, emulsifiers, emulsion stabilizers, suspending agents, and binders. 60 pages. *Organic Chemicals Sales, The Dow Chemical Co., Midland, Mich.*

Dry-coloring. "Improved Dry-Coloring of Grex High-Density Polyethylene" describes a new technique which employs a specially designed single breaker plate inserted behind the nozzle of an injection molding machine. 4 pages. *W. R. Grace & Co., Polymer Chemicals Div., 225 Allwood Rd., Clifton, N. J.*

Aluminum silicate pigments. Technical data on aluminum sili-

cate pigments in plastics, adhesives, paints, printing, and other industries. 4 pages. Technical Information No. 1001. *Minerals & Chemicals Corp. of America, Essex Turnpike, Menlo Park, N. J.*

TFE resin. Mechanical, electrical, chemical, and thermal properties, applications, etc., for Fluorosint TFE resin a polytetrafluoroethylene base composition designed to improve pure polytetrafluoroethylene without materially affecting its electrical and chemical characteristics. 4 pages. *The Polymer Corp. of Penna., Reading, Pa.*

Epoxy resins. "Epoxy resins—Applications and Advantages. A Guide to Resin Selection for: Plastic Tooling, Potting and Impregnating, Coating and Adhesion." 8 pages. *Marblette Corp., 37-31 Thirtieth St., Long Island City 1, N. Y.*

Special Tooling Services. Directory of 1000 contract tool and die plants in the U. S. and Canada, including products and services offered by each NTDMA member. 76 pages. *National Tool & Die Manufs. Assn., 907 Public Square Bldg., Cleveland 13, Ohio.*

Synthetic fiber. Data on Terylene, a strong synthetic polyester fiber that has good thermal and electrical insulation properties, resists rotting and weathering, and withstands acid attack. 34 pages. *Imperial Chemical Industries, Ltd., Fibres Div., Harrogate, England.*

Diepoxides. Properties and suggested uses of two new diepoxides, in epoxy and other resin systems as diluents, cross-linking agents, or modifiers. Bulletin 95. 6 pages. Dicyclopentadiene dioxide. Bulletin 96. 6 pages. Limonene dioxide. *Becco Chemical Div., Food Machinery & Chemical Corp., Station B, Buffalo 7, N. Y.*

Pipe and fittings. "Seal of Approval Listing of Plastic Materials, Pipe, and Fittings for Potable Water Supplies." 12 pages. *The National Sanitation Founda-*

tion, School of Public Health, University of Michigan, Ann Arbor, Mich.

Teflon terminals. Dimensions and performance data on over 200 subminiature Teflon terminals. 8 pages. Catalog SMT-2759. *Trinseel, Inc., 177 I. U. Willets Rd., Albertson, L. I., New York.*

Organic intermediates. List of approximately 100 available organic intermediates. 4 pages. *Aceto Chemical Co., Inc., 40-40 Lawrence St., Flushing 54, N. Y.*

Polyethylene. Technical data on five types of Marlex polyethylene. 4 pages. "More About Marlex" lists advantages, applications, etc. of Marlex. 14 pages. *Plastics Sales Div., Phillips Chemical Co., Adams Bldg., Bartlesville, Okla.*

Micaceous insulation. Descriptive data and application epoxy resin-bonded micaceous insulation for use with Class B electrical equipment. Technical Bulletin A-58. 8 pages. *Mica Insulator, Div. of Minnesota Mining & Mfg. Co., Schenectady 1, N. Y.*

Speed drives. Advantages, operation, and characteristics of fluid power "Any-Speed" drives for systems requiring constant power, constant torque, highly accurate closed loop hydraulic feedback method, etc. Bulletin 10600. 32 pages. *The Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.*

Cutter. Data on Model IV Versa Cutter for handling extruded plastics, rubber, and other compositions. 4 pages. *Foster & Allen, Inc., 626 South Ave., Garwood, N. J.*

Adipic acid. Properties, applications, bibliography, etc. relating to "Du Pont Adipic Acid and Its Derivatives." 78 pages. Price: $1.00. *Polychemicals Dept., E. I. du Pont de Nemours & Co., Inc., Wilmington 98, Del.*

Polyester films. Properties and characteristics, applications, etc., for Scotchpak transparent heat-sealable polyester films. 6 pages. *Minnesota Mining & Mfg. Co., 900 Bush St., St. Paul 6, Minn.*

Plastics

Production and sales figures in 1000 lb.* for March and April 1958

Materials	*Total p'd'n first 4 mos. of 1958‡*	*Total sales first 4 mos. of 1958‡*
Cellulose plastics:[a]		
Cellulose acetate and mixed ester:		
Sheet, under 0.003 gage	5,475	5,402
Sheet, 0.003 gage and over	6,238	5,315
All other sheets, rods, tubes	2,711	2,544
Molding, extrusion materials	26,920	26,446
Nitrocellulose sheets, rods, tubes	1,145	1,244
Other cellulose plastics	3,056	2,209
Phenolic and other tar-acid resins:		
Molding materials[a]	53,881	49,233
Bonding and adhesive resins for:		
Laminating (except plywood)	19,540	12,682
Coated and bonded abrasives	4,515	3,488
Friction materials (brake linings, clutch facings, etc.)	3,939	3,461
Thermal insulation	14,568	13,526
Plywood	15,512	13,182
All other bonding uses	12,710	12,528
Protective-coating resins	9,546	7,610
Resins for all other uses	9,310	6,805
Urea and melamine resins:		
Textile-treating resins	11,553	10,826
Paper-treating resins	8,780	7,054
Bonding and adhesive resins for:		
Plywood	27,690	28,518
All other bonding and adhesive uses, including laminating	13,046	12,076
Protective-coating resins	9,063	7,099
Resins for all other uses, including molding	32,561	30,268
Styrene resins:		
Molding materials[a]	126,908	139,018
Protective-coating resins	29,384	28,540
Resins for all other uses	50,714	41,179
Vinyl resins, total[b]	244,429	231,960
Polyvinyl chloride and copolymer resins (50% or more polyvinyl chloride) for:		
Film (resin content)		23,726
Sheeting (resin content)		17,422
Molding and extrusion (resin content)		61,313
Textile and paper treating and coating (resin content)		16,247
Flooring (resin content)		33,821
Protective coatings (resin content)		9,513
All other uses (resin content)		16,487
All other vinyl resins for:		
Adhesives (resin content)		14,725
All other uses (resin content)		38,705
Coumarone-indene and petroleum polymer resins:	75,225	73,842
Polyester resins:		
For reinforced plastics	30,815	28,091
For all other uses	3,230	3,008
Polyethylene resins total:	271,257	249,306
For film		102,900
For all other uses		146,326
Miscellaneous:		
Molding materials[a, d]	11,877	12,433
Protective-coating resins[e]	3,902	2,430
Resins for all other uses[f]	46,528	39,270

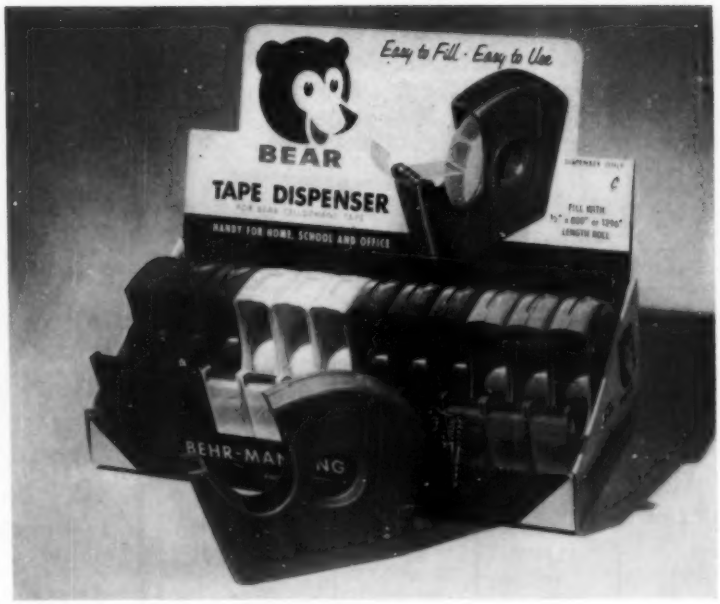
*Dry basis designated unless otherwise specified. †Revised.
‡Partially estimated.
[a]Includes fillers, plasticizers, and extenders. [b]Production statistics by uses are not representative, as end use may not be known at the time of manufacture. Therefore, only statistics on total production

Production

From statistics compiled by the U. S. Tariff Commission

March†		April‡	
Production	*Sales*	*Production*	*Sales*
1,680	1,688	1,276	1,275
1,490	1,424	1,778	1,410
653	734	699	591
7,653	7,493	6,452	6,093
278	302	229	275
736	572	775	512
†14,217	†12,832	10,728	11,515
†5,132	†3,636	4,473	2,651
†1,127	†841	1,055	842
†850	†743	767	743
†3,101	†3,344	3,845	3,459
3,840	3,223	4,022	3,784
†2,785	†2,914	2,836	2,888
†2,532	†1,872	2,353	1,938
†2,208	†1,614	1,677	1,410
2,817	2,566	2,732	2,425
1,953	1,729	2,154	1,757
7,363	†7,770	6,416	7,149
3,445	†3,135	3,323	2,873
2,293	†1,678	2,063	1,799
8,324	7,630	7,612	6,623
†32,933	†34,860	35,769	37,646
†7,453	†7,126	6,744	7,408
†12,905	†10,239	12,098	10,286
†62,698	†58,256	54,427	59,858
	†6,530		5,424
	†4,248		4,643
	†15,340		15,705
	†3,863		3,881
	†9,216		9,079
	†2,322		2,056
	†3,760		5,287
	†3,941		4,087
	†9,036		9,696
18,290	18,341	20,066	18,815
7,658	†6,635	9,221	8,671
978	779	745	830
†72,121	†63,109	66,813	69,186
	†29,718		26,558
	†33,311		42,628
2,817	2,781	2,616	2,924
†1,039	†528	956	723
†11,660	†9,769	12,697	10,983

are given. ᶜIncludes data for spreader and calendering-type resins. ᵈIncludes data for acrylic, nylon, and other molding materials. ᵉIncludes data for epichlorohydrin, acrylic, silicone, and other protective-coating resins. ᶠIncludes data for acrylic, rosin modifications, nylon, silicone, and other plastics and resins for miscellaneous uses.



Display rack of two-piece cellophane tape dispensers. Bright molded-in colors add to merchandising appeal of units

Molded styrene dispensers for cellophane tape

In entering the cellophane tape field, Behr-Manning Co., a Div. of Norton Co., Troy, N. Y., chose molded general-purpose styrene for its tape dispensers.

Three primary considerations dictated this choice. The material, though low in cost, offered all the properties required for normal use; its easy moldability reduced design problems and facilitated processing; and the almost limitless color range permitted the selection of brilliant hues as aids in merchandising the new product. In addition, the dispensers have several advantages over metal varieties, including softer feel, greater elasticity, and molded-in color.

The dispensers shown above retail for 29¢ each, without tape. They are molded in two pieces. In use, the two halves are firmly held together by a series of molded-in tongue-and-groove joints; but they come apart and can be rejoined easily at refill time. A metal cutting device, produced by the Metal Div. of the molder, seats securely in a molded-in "slot" so that it does not fall out when the two dispenser halves are separated. The units are injection molded on a Reed-Prentice machine in a six-cavity mold in grey, green, red, and white. Weight per shot is 3.8 ounces. The dispenser will take a roll of 800 or 1296 in., ½ in. wide. A close-up inside view of the two halves is shown below.

In addition to the two-piece dispenser, the company also merchandises a one-piece unit, a close-up of which is shown on the facing page. These are produced on an Impco machine in a 12-cavity combination injection

Inside view of two halves of large dispenser which is merchandised without tape to promote the sale of 800- and 1296-in. rolls. Tongue-and-groove joint locks unit

mold which incorporates several features to facilitate degating of the product. Weight of shot is 4.8 ounces.

The design of the unit involves careful mold construction and ingenious molding, including the use of side cores and automatic removal of parts, which is accomplished by spreading them out of the core.

The units have a carefully controlled degree of elasticity which assures that the two side pieces hold the roll of tape firmly but without binding or interfering with unwinding. Binding of the tape roll has long been a complaint of users of disposable tape dispensers made of metal.

Brand name and trademark are stamped on both sides of the dispenser at one time, using a press specifically designed for this job. The units are produced in red, blue, yellow, and white and will accept 200-in. rolls of tape.

Distribution for both the one-piece and two-piece units is through hardware and paint jobbers to retail stores in those fields, and through paper jobbers to office supply and related stores.

Credits: Molding by Waterbury Companies, Inc., Waterbury, Conn.; molds by Model Tool Co., Bridgeport, Conn.; stamping equipment by Peerless Roll Leaf Co., Inc., Union City, N. J.; design by Nash Associates, 527 Madison Ave., New York, N. Y.; general purpose polystyrene by The Dow Chemical Co.

One-piece dispenser for small rolls of ½-in. tape is designed so that the sides of the molded unit give just the right tension to hold the roll without binding

Photo, B. F. Goodrich Chemical Co.

Vinyl shoes—for sheep and dogs

It is a far cry from the Hollywood pup wearing the fancy boots, shown above, to protect it from the discomforts of rocks, thorns, mud, etc., and a sick sheep in Australia which wears the shoe shown below. But both products are slush molded of vinyl.

The pup's boots are made by Hansen Handicrafts, Monrovia, Calif., from a combination of Geon vinyl resins, and are marketed by Anne Ardmore's Hollywood Dog Togs, Sherman Oaks, Calif.

The sheep shoes are manufactured by Moulded Products (Australasia) Limited, Melbourne, Australia. They are proving most satisfactory in the control of footrot, a germ-caused disease which, if allowed to get out of control, could lead to serious consequences.

Footrot is caused by a germ bred in the soil. It affects the horn-growing tissues of the hoof, causing them to become soft, inflamed, and so painful that the sheep cannot walk. The animal does not feed, becomes ill, and has to be destroyed. Footrot can be transmitted to "clean" sheep by contaminated hoofprints.

Farmers in the State of Victoria in Australia are compelled by law to treat their flocks twice a year by driving the sheep through a bath consisting of a 5% formalin solution. However, in stubborn cases of footrot, the hooves must be treated independently and this is where the shoe comes in.

The shoe is made from polyvinyl chloride and is composed of a molded bottom with a 1-in. thick polyurethane sponge insert and a flexible perforated upper, which is welded to the bottom cup. The upper has a stipple rubber lining on the top held in position on the sheep's leg by snap fasteners.

In use, the shoe is fitted to the affected hoof after the polyurethane sponge has been soaked with a 5% formalin solution. The bottom half of the shoe, therefore, acts as a poultice, allowing the formalin to destroy the germ; the top section of the shoe, being soft and perforated, prevents sweating.

Many thousands of these sheep shoes are now in use, enabling footrot infested sheep to move about in comfort.—End

Blaw-Knox designs for Goodyear...

mammoth expansion creates the world's largest synthetic rubber plant

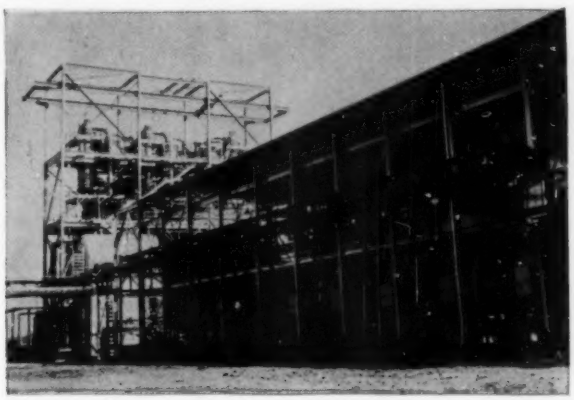
Designed by Blaw-Knox, this $10 million expansion boosts capacity at Goodyear's Houston synthetic rubber plant to 220,000 long tons a year. With this 50% increase in output, this plant becomes the world's largest single producer of dry type synthetic rubber.

Goodyear and Blaw-Knox have been doing big things together for over fifteen years—from Goodyear's first monomer purification facilities to the current construction of the first synthetic rubber plant in Great Britain.*

Repeat business in many diversified fields occurs regularly at Blaw-Knox. But this kind of *continuous endorsement* is not easily earned. It takes solid engineering skill and broad technical experience to assure results that win future assignments.

To see how this endorsed know-how can help you with your plans for erection, expansion or modernization of your plant, contact Blaw-Knox.

*A facility owned in part by Goodyear Tire & Rubber Co. (Great Britain), Ltd.



Two lines of reactors—each containing 11-5,000 gallon reactors along with three stripping columns form the heart of new plant expansion.

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Chemical Plants Division with headquarters in Pittsburgh

Branch offices in New York, Chicago, Haddon Heights, N.J., Birmingham, Washington, D.C., San Francisco

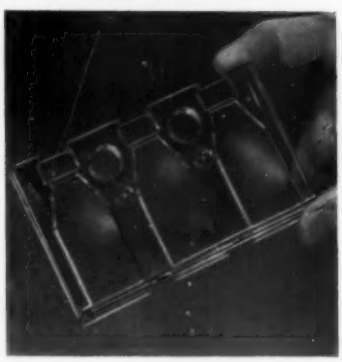
Methylstyrene covers for circuit breakers

A long-standing customer objection to lack of visibility of contacts in electrical circuit breakers has now been overcome. Standard Control Div., Westinghouse Electric Corp., Beaver, Pa., has introduced a line of circuit breakers with removable transparent covers through which it is possible to see at a glance whether contacts are open or closed. Any darkening of the cover indicates a serious short circuit.

When the plastic "windows" have become stained because of a short circuit, they can be easily replaced.

The cover is molded of Cymac 201 methylstyrene-acrylonitrile copolymer (American Cyanamid) by Westinghouse. The material provides the necessary transparency, heat and break resistance, and surface hardness. Covers are made in a range of sizes to fit various circuit breakers. They are available in sets of 10 at $15 per set.—END

Transparent methylstyrene-acrylonitrile cover on circuit breaker reveals at a glance whether contacts are open or closed. Photo at bottom shows cover itself



Construction set molded by polyethylene took first prize in Class 1 (Hobbycraft Products) of the plastics design competition reported below. (Photos, Koppers)

Toy design competition awards

The fourth annual plastics design competition sponsored by Koppers Co., Inc., Pittsburgh, Pa., embraced the toy field; the three previous competitions were limited to housewares. The toy contest evoked a healthy response from molders of plastics toys—it drew nearly 400 entries from 112 manufacturers. All the top prizes were taken by polyethylene products.

Five categories were set up by Koppers: Class 1, hobbycraft products; Class 2, playtoys retailing for more than $5; Class 3, playtoys retailing between $1 and $5; Class 4, playtoys retailing under $1; Class 5, infant items.

First prize in Class 1 was awarded to Vanguard Toy Co., Buffalo, N. Y., for a construction set molded of polyethylene and illustrated above.

First prize in Class 2 went to Mattel Inc., Los Angeles, Calif., for a set of polyethylene barbells, In Class 3, the top prize went to Cosom Industries, Inc., Minneapolis, Minn., for a baseball set consisting of an injection molded polyethylene bat and hollow ball. These products, which are shown at right, were custom molded by Rainbow Plastic Products Co., Minneapolis. The first prize in Class 4 went to Knickerbocker Plastic Co., Inc., N. Hollywood, Calif., for a beach boat molded of high-density polyethylene. Class 5, for infant items, was won by Fisher-Price Toys, Inc., E. Aurora, N. Y., with a set of giant snap-lock play beads, also molded of polyethylene.

All the prizes in the contest consisted of awards of $1000 to camps for handicapped children chosen by the prize winners. All winning entries in the competition were judged on the basis of design, proper application and imaginative use of material, and sound construction.—END

Bat and ball set, also of polyethylene, won first prize in Class 3 of the competition

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Maximum jetness... maximum gloss for your black vinyl products... with

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COLUMBIAN CARBON COMPANY

380 Madison Avenue, New York 17, N. Y.

Compact survival kit case in open position. In right foreground is oxygen tank which allows pilot to breathe during descent through rarified atmosphere; in left rear is radio; at right rear is life raft

Survival kit housed in RP case

Jet pilots bailing out of high-flying aircraft have a better chance of coming through alive, thanks to a recently perfected survival kit. An essential component of the kit is its molded reinforced plastics case in which survival gear and necessary accessories are housed.

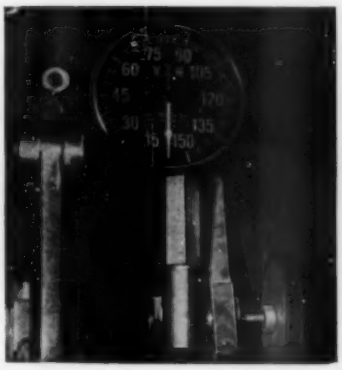
The case, measuring 19¼ by 16 by 6¼ in. is produced with two molded-in compartments, one of which provides a seating area for the airman, and the other a parachute support ledge, in addition to holding the gear. Reinforced plastics were chosen because they made possible a case that would withstand loads imposed by ejection seat catapults for MIL-S-9479 seats, would prevent crushing of internal items, and would not injure the back of the flyer.

The case remains attached to the ejected pilot until he has reached breathable atmosphere. He then pulls a disconnect lever, dropping the kit 12 ft. below him. The kit then opens and a life raft is automatically inflated, providing a ready made lifeboat.

Credits: Molded by H. Koch & Sons, Corte Madera, Calif., using Rohm & Haas Paraplex polyester resin reinforced with Owens-Corning mat and Pittsburgh Plate Glass roving.

JONES SURFACE SPEED INDICATOR

A Tachometer with a Friction Contact Wheel



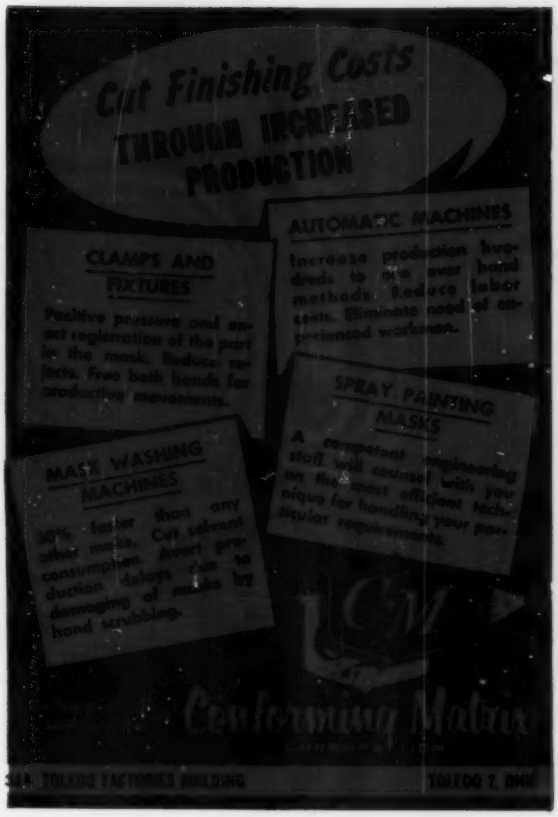
Like other Jones Tachometers, the Surface Speed Indicator gives accurate, dependable and continuous readings of machine speed in RPM's, YPM's or FPM's. Only the surface indicator can be engaged or disengaged at will by merely dropping or lifting a friction wheel suspended in a bracket over the work or revolving part.

Wheel rides on work—eliminates linkage — According to an important manufacturer of dyeing and printing machines in the textile field, the Surface Speed Indicator assures greater accuracy because it derives its speed directly from the material itself or the surface on which the material is moving instead of by means of mechanical linkages and gears.

Jones Motrola Corporation has been building tachometers for every conceivable type of application for over 35 years. Jones Tachometers are considered indispensable to proper production and quality control in such industries as automotive, textile, paperboard and machine tooling.

For information about this and other types of fixed and portable tachometers write for Bulletin SSI-5.

JONES MOTROLA CORPORATION, STAMFORD, CONN.



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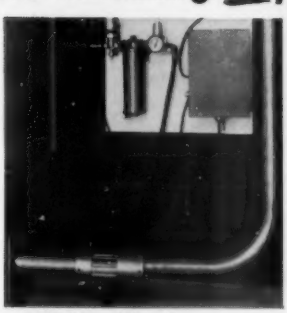
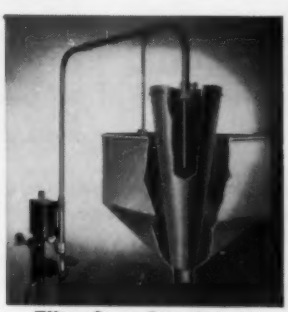
Dehumidifies drying air to a minus 20 dew point in a closed system - preheats material - capacities to 600 lbs. per hour.



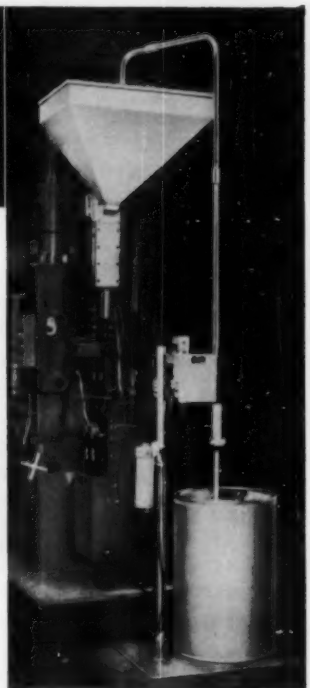
Bulk Handling Conveyors

Automatic or manual - capacities to 2,500 lbs. per hour.



Filter Cone Attachment

Automatic - eliminates dust caused when transferring plastic materials.



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Plasticizer Data
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these Harflex® Polymeric Plasticizers are permanent

Harflex 300 polymeric plasticizer

non-migratory
fast processing
excellent dry blending
good low temperature properties
can be used as sole plasticizer

physical data		heat stability (180°C.)	
100% Modulus	1320 psi	Initial Discoloration	15 min.
Tensile Strength	2695 psi	Maximum Discoloration	90 min.
Elongation	338%	**extraction loss**	
Hardness, Shore A	80	Water	0.21%
T_f	−17.3°C.	1% Soap	3.45%
Flux Time	45 seconds	Mineral Oil	2.10%

migration

Lacquer, 25°C., 14 days	Very slight softening
Varnish, 25°C., 14 days	No effect
Polystyrene, 60°C., 19 days	No effect

Harflex 325 polymeric plasticizer

economical
non-migratory, permanent

Both these Polymerics are used with Vinyl Chloride Polymers and Copolymers, Polyvinyl Acetate, Synthetic Rubbers, Nitrocellulose, Cellulose Acetobutyrate, and Polymethyl Methacrylate.

physical data		heat stability (180°C.)	
100% Modulus	1320 psi	Initial Discoloration	15 min.
Tensile Strength	2471 psi	Maximum Discoloration	90 min.
Elongation	350%	**extraction loss**	
Hardness, Shore A	76	1% Soap	2.6%
T_f	−12.5°C.	Mineral Oil	1.2%
Flux Time	60 seconds		

migration

Lacquer, 25°C., 14 days	Slight staining, very slight softening
Varnish, 25°C., 14 days	Slight staining
Polystyrene, 60°C., 19 days	No effect

Harchem produces a full line of phthalate, adipate, sebacate and polymeric plasticizers in addition to the plasticizers shown.

The Harchem Division laboratories will gladly assist you with your plasticizer problems, or will supply additional data including formulation test methods and formulation suggestions for any Harflex Plasticizer.

Address inquiries to Dept. H-42.60

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PHTHALATES
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CAST ACRYLIC SHEETS. 4-page leaflet describes the properties of a new precision cast acrylic sheet with close thickness tolerances and high optical clarity for windshields, signs, domes, cake box covers, etc. Cast Optics Corporation. **(H-801)**

INJECTION MOLDING MACHINE. Illustrated 6-page booklet describes an hydraulic press designed to overcome problem of molding around inserts and cores. Press handles mold sizes of 6" x 5" x 5¼". Specifications listed. Newbury Industries, Inc. **(H-802)**

TOGGLE PRESS. 4-page illustrated release describes self-contained, semi-automatic compression and transfer toggle press, featuring a bar controller which automatically regulates phases of the molding cycle. F. J. Stokes Corp. **(H-803)**

INJECTION MACHINES. 4-page bulletin discusses the design, construction, and operation of a line of 1½ to 2 oz. high-speed, self-contained hydraulic injection machines that perform at up to 690 cycles per hour. Guy Harvey & Son Corp. **(H-804)**

FLEXIBLE PLASTIC TUBING. Technical bulletin describes a line of flexible, high strength, waterproof tubing made of laminated plastic materials. For liquids and gases under pressure, acids, alkalis, electrical and electronic equipment, etc. Airconductors. **(H-805)**

PVC RESIN. Technical bulletin lists the chemical and electrical properties, applications of a high molecular weight polyvinyl chloride resin, designed for extrusion and calendering operations. Diamond Alkali Co. **(H-806)**

INJECTION MOLDING MACHINES. Illustrated 26-page catalog contains information on a line of 4–32 oz. automatic injection molding machines. Includes specifications, design and operational features, optional equipment. Reed-Prentice Div., Package Machinery Co. **(H-807)**

PLASTICS GRANULATOR. Illustrated 16-page booklet describes the features of lines of plastics pre-breaking machines; central and "beside the press" granulators; and chopping, dicing and pelletizing machines. Includes diagrams and technical data. Cumberland Engineering Co., Inc. **(H-808)**

METALLIZED THERMOPLASTIC SHEETING. Bulletins describe services for metallizing, coating, and coloring thermoplastic sheet materials; and laminating them to each other or to other materials. Include price lists and color card. Gomar Mfg. Co., Inc. **(H-809)**

FIBERGLASS PANELS. Illustrated 4-page folder presents specifications for a line of translucent fiberglass panels. Leaflet itemizes light and heat transmission values for 32 different Alsynite panels. Alsynite Co. of America. **(H-810)**

MOISTURE TESTER. Illustrated 6-page folder describes design and operational features of a semi-automatic, two-step machine for determining the moisture content of organic and inorganic materials, and showing moisture percentage readings directly on dial. C. W. Brabender Instruments, Inc. **(H-811)**

PLASTICITY MEASURER. Illustrated release describes a line of instruments for measuring and recording, in graph form, the consistency, absorption, swelling, mixing requirements, mixing tolerance, breakdown, etc., of plastic materials. Brabender Corporation. **(H-812)**

PASTE DISPERSIONS. Release outlines advantages and mixing instructions for pigment dispersions developed for polyesters, epoxies, acrylics, vinyls, and foams. Includes price schedules. Pigment Dispersions, Inc. **(H-813)**

THREE-PLATE MOLD SETS. Illustrated 4-page bulletin describes the features of a series of newly standardized three-plate mold sets, which feature "floating plates," reportedly solving the linear motion problem. Nat'l Tool & Mfg. Co. **(H-814)**

EXTRUSION EQUIPMENT. Folder contains diagrams and specifications of custom manufactured torpedo, forwarding, mixer and devolatizer, and feed extrusion screws. Johnson Mfg. Co. **(H-815)**

EPOXY RESIN MODIFIERS. 4-page technical bulletin describes advantages, lists physical properties of two liquid polymers which respectively extend and flexibilize epoxy resins. For casting, potting, sealing, plastic tooling, laminating, coating, etc. Thiokol Chem. Corp. **(H-816)**

PLASTIC DYESTUFFS. Brochure pictures and describes applications of this company's lines of lacquers, dyes, adhesives, and cleaners, for acrylics, butyrate, styrene, vinyls, etc. Schwartz Chemical Co., Inc. **(H-817)**

ANTI-STATIC MOLD RELEASE. Catalog sheet describes an inert, invisible coating for eliminating static charges on dies, as well as lubricating them and preventing rust. Includes price list. Optics Manufacturing Corp. **(H-818)**

NYLON SHAPES. Illustrated 16-page booklet discusses the properties, fabricating techniques, and uses of "Polypenco" nylons, available in rods, strips, plates, tubing, and tubular bars. The Polymer Corp. of Pa. **(H-819)**

POLYETHYLENE RESIN. 8-page bulletin describes a low molecular weight polyethylene resin, which, because of a low melt viscosity and retention of tensile and chemical properties, could be used as a polyethylene hot melt in the roll coating of paper for packaging. Eastman Chem. Prod., Inc. **(H-820)**

INDUSTRIAL RESINS. Illustrated 12-page booklet covers the properties and uses of this company's resins in rubber compounding, cement and adhesive formulation; and the manufacture of bag molded formed plywood, brake linings, abrasive papers, electrical parts, etc. Durez Plastics Div., Hooker Chem. Corp. **(H-821)**

AIR CLEANER. Illustrated 8-page brochure describes the construction and operational features of a line of knocked-down or assembled machines for controlling dust and fumes by means of cloth filter tubes. Wheelabrator Corp. **(H-822)**

EPOXY COLOR PASTES. 4-page folder describes the properties and uses of epoxy color paste compounds in casting, sealing, molding, extruding, potting, coating, and other operations. Includes colors. The Clinton Company. **(H-823)**

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INJECTION MOLDING MACHINE. Illustrated data sheets describe features of an automatic 2⅝ oz. horizontal plastics injection molding press, for plasticizing up to 30 pounds plus per hour. Includes specifications, prices. The Van Dorn Iron Works Co. **(H-825)**

DRUM TUMBLERS. Illustrated 4-page folder presents specifications, prices for ¾ HP, 2 HP, and 3 HP disposable-drum models for dry color mixing. Lists specifications, prices. Injection Molders Supply Co. **(H-826)**

PLASTIC BOTTLE BLOWER. Illustrated 4-page brochure presents features of an automatic machine for making finished bottles up to one liter, doll heads and other hollow items from all thermoplastic materials. The Blow-O-Matic Corp. **(H-827)**

CONVEYORS FOR PLASTICS. 4-page folder pictures and describes lines of manually and automatically operated self-supporting and large capacity conveyors for all plastic materials. Includes special conveyors and attachments. Whitlock Associates, Inc. **(H-828)**

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FLEXIBLE CONVERTING MACHINERY. Illustrated data sheet folder describes features of an automatic vacuum forming machine, a sheet tester, an automatic filler and sealer, and a semi-automatic laboratory vacuum forming machine. Roto Bag-Holweg Div., Conapac Machine Co. **(H-832)**

GLASS FIBER MOLDING COMPOUNDS. Illustrated brochure and data sheets describe physical, mechanical, electrical, chemical properties of a line of polyester resin-coated glass fiber compounds for molding of electrical switches, propellers, handles, trays, etc. Plumb Chemical Corp. **(H-833)**

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QUARTZ IMMERSION HEATERS. Illustrated folder describes lines of laboratory and shop fused quartz immersion heaters for pickling, plating, and electropolishing. Units feature portability, light weight, high heat density. Bulletin includes prices, application data. Cleveland Process Corp. **(H-836)**

PLASTICS GRANULATORS. Illustrated 4-page folder describes construction and operational features of a line of rotary knife thermoplastics scrap granulators with capacities from 100 to 400 pounds per hour. Includes specifications, diagrams. American Pulverizer Co. **(H-837)**

COLORANTS FOR PLASTICS. 4-page technical bulletin describes the general properties of each of the grades of Cadmium Selenide Red, Mercury-Cadmium Red, and Cadmium Yellows produced by this company for thermoplastic and thermosetting resins. Includes color chips, physical constants, applications. Kentucky Color and Chem. Co., Inc. **(H-838)**

FLUOROCARBON PLASTIC LAMINATES. Illustrated 4-page folder describes lining, surfacing applications for corrosion, chemical, and contamination-resistant "Kel-F" fluorocarbon plastic laminates. Includes discussions of properties, structure, installation, seaming, and suppliers. The M. W. Kellogg Co. **(H-839)**

POLYETHYLENE TUBING SAMPLE CARDS. Set of three cards containing samples illustrates various grades of polyethylene tubing available from this company. Strength, clarity, gloss, and slip ratings are indicated for each grade. Andmar Plastic Co., Inc. **(H-840)**

POLYETHYLENE, VINYL, NYLON AGENTS. Technical data folder describes the properties of an agent for preventing static, tackiness, blocking, in polyethylene extrusion; an anti-static agent for nylon and synthetic blends; and an anti-blocking agent for vinyl film and sheeting. Fine Organics, Inc. **(H-841)**

TEMPERATURE CONTROLLERS. Illustrated folder lists features, specifications for a line of electronic temperature indicating controllers which operate with on-off, proportional, or adjustable differential controls. For extruding, injection molding, etc. Fenwal, Inc. **(H-842)**

ODORANTS FOR PLASTICS. 8-page booklet discusses nature and causes of bad odor in plastics and describes masking techniques. Includes lists of concentrated, emulsified, solubilized odorants, and thermoscents. Fritzsche Bros., Inc. **(H-843)**

ROLL-LEAF STAMPING PRESSES. Illustrated folder describes lines of light, medium, and heavy-duty hand and air-operated roll-leaf stamping equipment for items up to 24 in. high. Includes specifications, accessory equipment, supplies. Olsenmark Corp. **(H-844)**

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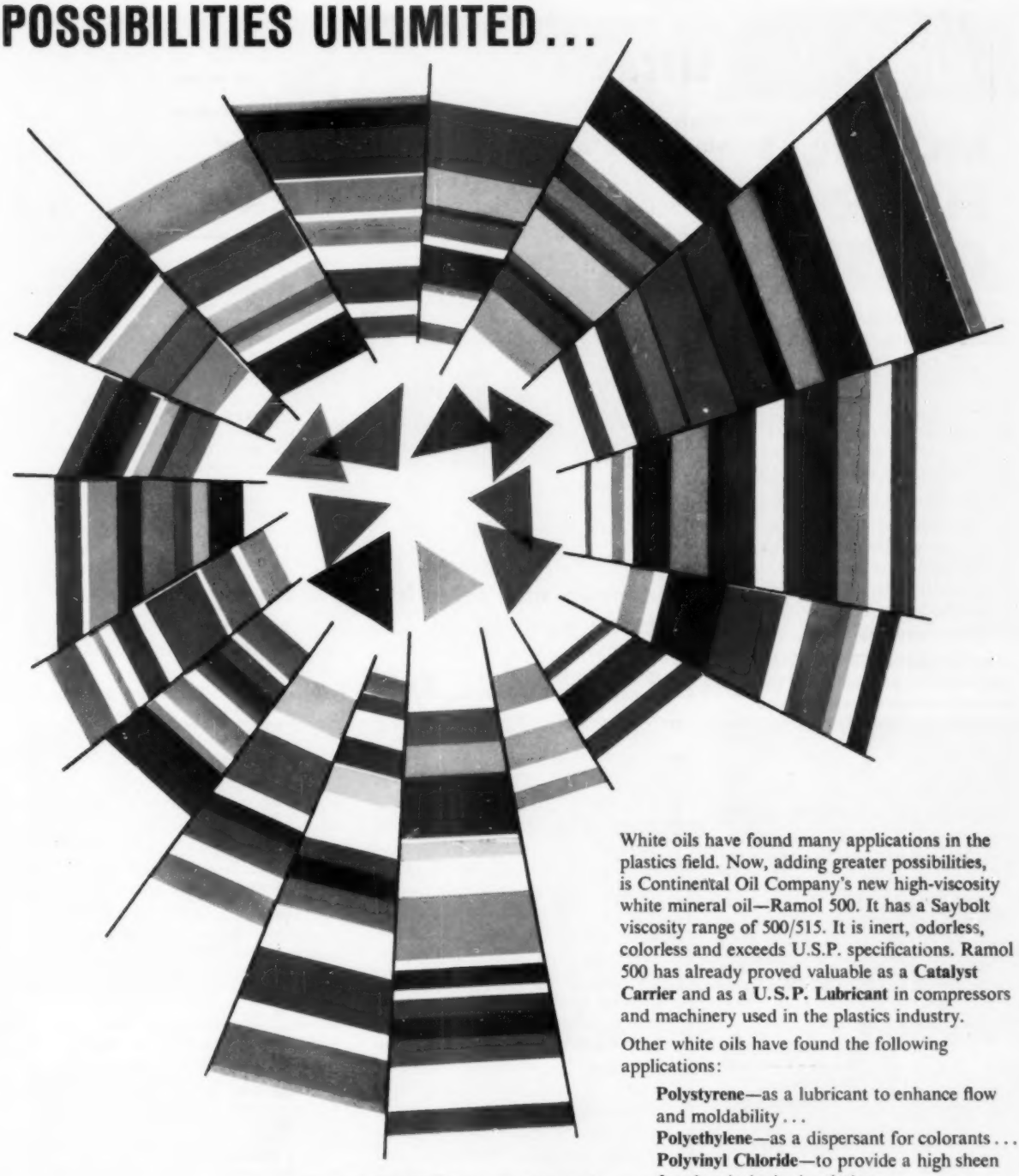

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Methods for easy opening of polyethylene-wrapped packages: top left—peelable seal; top right—perforated film; bottom left—tear tape; and bottom right—tear tape of polyethylene beads

Easy-to-open polyethylene-wrapped packages

One of the problems of using polyethylene film as a packaging material—that of opening the package easily—is being tackled at the material makers' level with promising results.

A good example is the research being done at the packaging laboratory of Bakelite Co., Bound Brook, N. J. Work there has led to the development of three systems for "building-in" ease of opening into a package. All three can be used with existing packaging machines. A fourth, though successful on laboratory scale, does not yet lend itself to commercial application. The systems are as follows:

1) Peelable seals. These are obtained by applying sufficient heat to the end fold or underfolds to form a seal that can be peeled open by the user but that is strong enough to withstand constant handling of the package prior to sale.

2) Perforating. By using film that has been perforated at the seal area, opening is made easy, while strength of unopened package remains relatively unimpaired. A commercial application of this type is found in the polyethylene bags just introduced to the record trade by Equitable Paper Bag Co., Inc., Long Island City, N. Y.

3) Tear tapes. The problem here is that the film stretches under tension, resulting in a jagged line when the tape is pulled. Two ways of overcoming this have been suggested. In the first, a tear tape material is heat-sealed to the film. In effect, the heat damages the film along the edge to the extent that the force required to tear along the tape is reduced to less than the tear resistance of the film. While tape is in place, the durability of the package is unaffected. The other involves the use of a thread and adhesive-backed tape. The tape is applied to the film over the thread. The thread is then embedded into the film by application of heat. When opening the package, the thread cuts the film while the tape prevents it from stretching.

4) Extruded beads. This modification of tear tape systems is not yet commercially feasible. Three parallel beads of polyethylene are extruded over the seal area. The outer two beads prevent the film from stretching, while the middle bead serves as a tear tape.

The film used in these experiments was 1.5 mils thick. Tear tape materials were also applied to 1.25 and 1.0 mil films with the same results.—END

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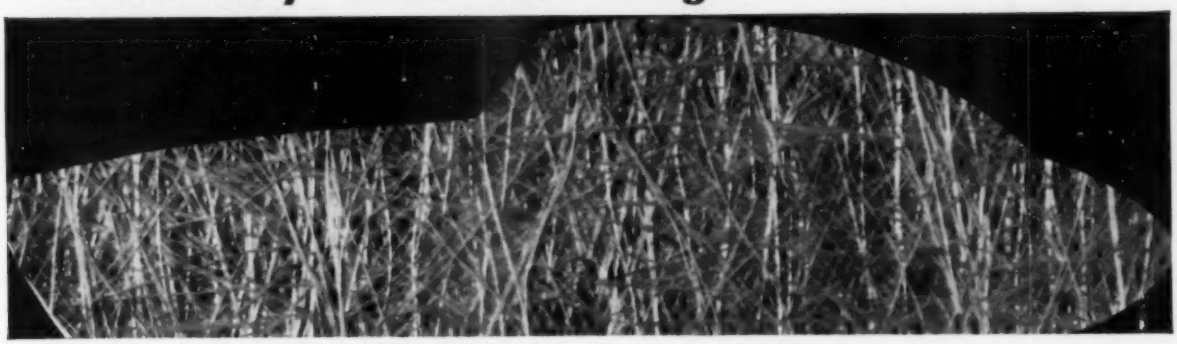

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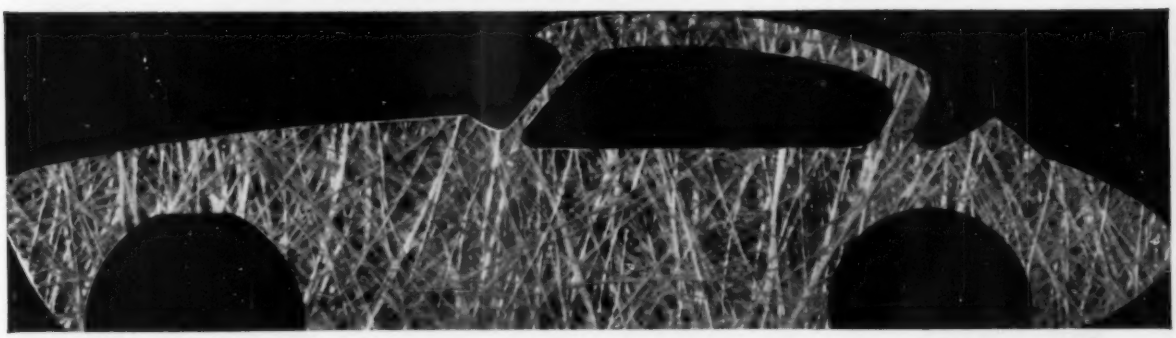

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Automated molding

(*From pp.* 85-89)

labor cost of slightly over $1/1000 pieces.

The other case histories illustrated on p. 85 speak for themselves. Literally scores more could be shown but the point need not be belabored. So where is this whole proposition heading?

First, the material makers are now producing a wide selection of thermoset materials for automatic molding. Second, there are a variety of equipment approaches to thermoset operation. Baker Brothers Inc., F. J. Stokes Corp., Automatic Molding Machine Co., and others are making bigger and bigger machines as automated molding is required for large parts. Hydraulic Press Mfg. Co., Atlas Hydraulics Inc., Adamson United Co., Lewis Welding & Engineering Corp., Allied Engineering & Production Corp., Hull-Standard Corp., all report impending new developments.

Coming up are new developments in fully automatic transfer molding. Hull-Standard has a unit which is declared to have performed wonders in lowering costs on small and delicate parts. Lester-Phoenix, Inc. some time ago introduced a fully automatic transfer machine which is on record as having decreased cycles from 165 sec. each to 24 seconds.

An important consideration in the use of automation for thermosets is part design. The rules are fairly simple: 1) Leave out the inserts. It is much cheaper to mold automatically and then press in the inserts than it is to mold them in semi-automatically. 2) Design for elimination of thin sections and narrow unsupported edges in the mold. 3) Stay away from blind holes deeper than three times their diameter. 4) Work closely with your material supplier for product consistency.

Probably 90% of the automatic presses installed to date are in captive plants. Why have more custom thermoset molders not taken up automation? Many reasons are given but they all boil down to: a) lack of appreciation of the costing principles used in the foregoing basic study; b) lack of realization of the fact that annual obsolescence of plastics parts is becoming the rule rather than the exception; and c) too much financial affection for obsolete equipment.

The purpose of automation in thermoset molding is not primarily to cut labor costs, not primarily to speed up the cycle. The purpose is to make more money by saving money through increased production, through increased yield from fewer cavities, through exact process control, and through the most efficient use of time.

For eight years it has been practical to run automatic compression presses 168 hr. a week, week after week, untouched by human hands. With labor costs looming higher and higher, with the challenge to economical and precision production looming ever greater (particularly in the thermosets), we are rapidly coming to the point where nobody can afford not to automate.—End

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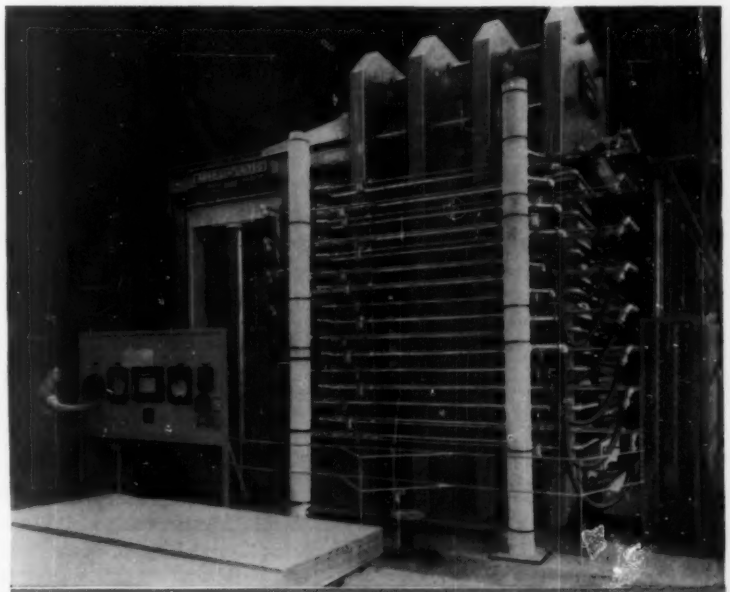

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Footwear

(*From pp. 90-92*)

facture will prove to be a production method rather than any material. Extrusion molding, a combination of the best features of extrusion and injection molding developed abroad, can produce an entire molded shoe in one automatic operation. Casual and play shoes for men, women, and children are being produced by this method at rates up to two pairs of shoes per minute. PVC and polyethylene are the plastics involved. The technique can also be used to attach a plastic shoe bottom—heel and sole—to a canvas upper. It is reported that 19 million pairs of molded shoes—both all plastic and with canvas uppers—were sold in France last year.

The development has moved to the U.S. International Vulcanizing Corp., Boston, Mass., which is distributing an extrusion molding machine called the Foster-Wucher W700. Separately, a company called Utrilon Corp. has been organized under the laws of Delaware to produce plastics footwear exclusively. Present plans of the company are for an annual production capacity of 2 million pairs of molded shoes a year, with manufacturing split up among six plants in the U. S., each housing six molding machines. The shoes will primarily be for summer, casual, and beach wear, but storm footwear will also be produced. The molded shoes, of a PVC formulation, can be produced clear, in a variety of opaque colors, and in metallic tints.

The extrusion molding technique opens up a whole new vista of plastics' stake in footwear. If completely molded shoes catch on—and a certain market for them would seem assured in casual and play shoes—it will mean a new outlet for millions of pounds of molding materials. In addition, there is room for further expansion of molded thermoplastic heels in women's dress shoes. There is also room for much greater consumption of polyethylene shoe parts for men's shoes as well as for soles of rubber-resin blends.—END

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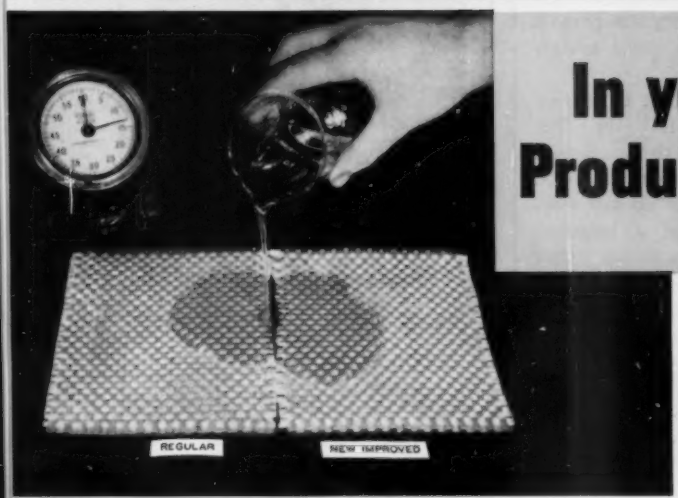
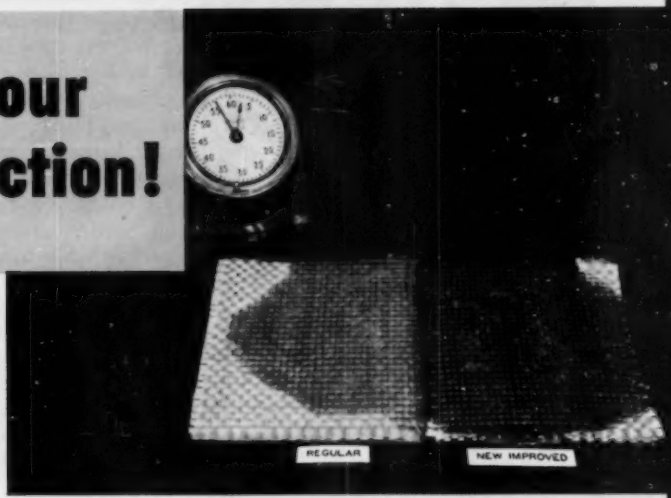
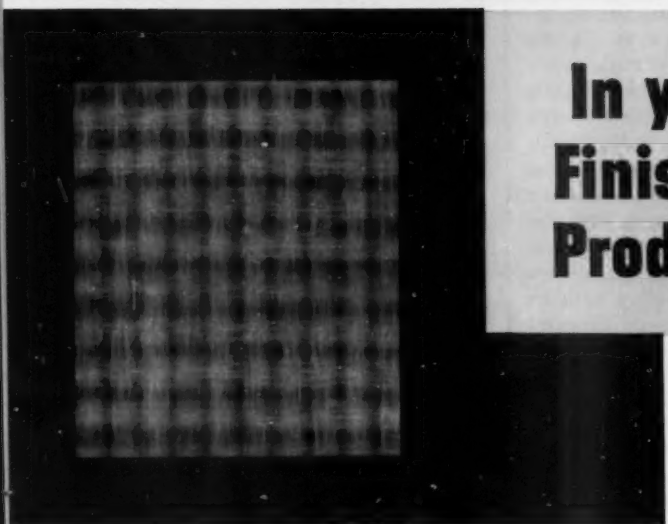


In your Production!





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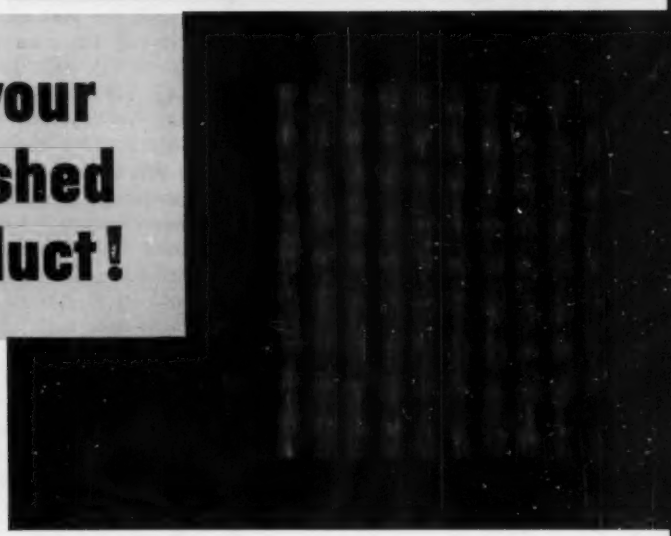

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Musical toys

(*From pp.* 102-103)

reducing costs by approximately 60 percent. The shaft is produced on 3-oz. Fellows machine, using a two-piece, two-cavity die (Fig. 3, p. 103). It runs in brass eyelets (F in Fig. 2).

Rigidity of the shaft is assured by four length-wise ribs. The eight loops are so designed that the percussive rings can be slipped in through openings on one side.

In order to find a battery-operated electric motor that would run at constant speed and still be inexpensive, the company tried motors from many countries. A small American-made motor (G in Fig. 2), which runs with virtually no vibration or noise, was finally selected. Any residual vibration is absorbed by a polyethylene mounted bracket.

All the rest of the organ, including the case (H in Fig. 2), frame (I), individual keys, music rack (J), base (K), and trim strip (L) are injection molded of styrene in the Knickerbocker plant.

The Electric Vibraphone has the same type of extruded aluminum tone bars as the organ, and also uses an electric motor. It is an orthodox-looking toy xylophone molded of styrene alloy with an eight-note scale of bars mounted on neoprene shock absorbers, but here the similarity ends. The base contains eight carefully designed molded-in resonant chambers, (see sketch insert, Fig. 4, p. 103), each exposed to the bar above by a circular opening. It took careful molding to produce a part with minimum of evidence on the flat base that deep heavy ribs are present on the other side.

These eight resonance apertures are opened and closed by flat polyethylene disks molded onto a motor-driven shaft running the length of the instrument. The disks act as flutter valves, constantly opening and closing the resonant air columns leading to the resonance chambers to produce a tremolo effect. The case itself, and the music rack, are of impact styrene alloy.

The notes are identified by color code, numbers, and note scale. Both instruments are pitched to the same scale.—END

R P pipe

(*From pp.* 96-101)

just 10% of the yearly replacement pipe market in the chemical industry would change this overcapacity to undercapacity. This alludes to present piping which has a service life of less than two years. Add to this the growing specifications for reinforced plastics pipe in new plants and lines and the present capacity does indeed fade to insignificance by 1960. This corrosion market is only part of the market, however. There are literally thousands of structural and electrical applications into which the lower-cost reinforced plastics goods fit. Furthermore, as longer service is proven, the replacement of metal pipe—which now lasts only three to five years—can be shown economically sound; hence, the triple factors of service satisfaction, increased customer understanding, and lower costs indicates a vast market potential.

The oil field market does require a lower-cost product, yet even in this field the market is very large even with a premium-cost pipe because of widespread corrosion in high pressure lines and well tubing.

But those who see reinforced plastics pipe replacing the really inexpensive mass produced steel, where steel is sound in the mass of applications, are indeed having a "pipe dream." Even if the cost base of the plastics pipe compared favorably to steel (which it does not), the skills, raw material facilities, or monies available to make an early dent in such a huge market do not exist. Present growth requirements will tax this young industry.

No appraisal of the future of this reinforced plastics pipe is intelligent if we neglect the financial, management, and marketing aspects.

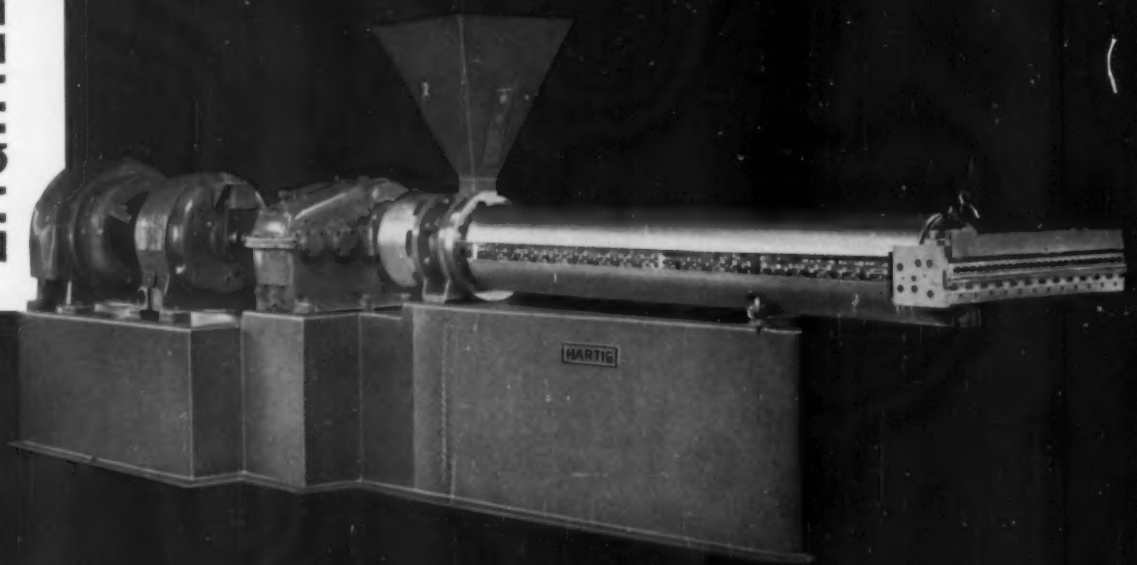
All but one of the present producers are diversification operations under the control of industries engaged in marketing widely associated products. In a way reinforced plastics pipe may be thought of as either a threat or a blessing to the parent operations. Intelligent thinking will remove

(*To page* 192)

ENGINEERED INSTALLATIONS

HARTIG extruders and matched auxiliary equipment

Hartig 4½" Extra Long Extruder, 24:1 L/D with sheeting die



for

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- Film Extrusion — Blown Tubing, Unsupported Film, Laminating
- Wire and Cable — Insulation and Sheaths
- Pipe, Tubing, Rod and Profile Extrusion
- Blown Containers — Molding
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Polystyrene	Vinylidene Chloride	Casein
	Polypropylene	Polyvinyl Butyrate
Cellulose Acetate	Rubber	Ethyl Cellulose
Cellulose Acetate-Butyrate	Fluorothene	Polyethylene

extruder specifications

sizes	1¼" to 12"
capacities	15 lbs./hr to 3000 lbs./hr depending on the nature of the job.
L/D ratios	15:1, 21:1, 24:1, and 30:1
drive	Variable speed motor. Herringbone gear reducers.
thrust bearing	Spherical roller bearing for radial loads, and self aligning spherical roller bearing for thrust loads—completely enclosed in a bronze housing and force lubricated.
feed	Fabricated throat section with provision for water cooling.
cylinder	Steel barrel with centrifugally cast Xaloy liner.
screw	Alloy or stainless steel with stellite tipped flights. Constant pitch, decreasing depth, or variable pitch. Self venting, recirculating.
closure	Clamp type.
temperature controls	Heated by means of band heaters or cast-in-aluminum calrod units. Controls are proportioning type or stepless (saturable core reactors). Cooled by controlled air or water along entire length of barrel.
venting and devolatilizing	Special screw construction for elimination of porosity, optional.

auxiliary equipment

dies	Film or laminating dies for widths up to 120". Blown tubing dies up to 48" diameter, and for lay-flat tubing up to 144". Pipe dies, profile dies. Sizing and cooling dies. Adjustable centering crossheads. Special purpose dies.
payoffs, takeoffs troughs	Film takeup units—for widths to 120". Blown tubing takeup units with collapsing roll assembly. Constant tension. Also available for lay-flat tubing up to 144". Pipe pulloff units. Water troughs. Capstans. Dual reel high speed continuous takeup with adjustable traverse. Constant tension, counter. High speed payoff stand with automatic brakes and dancer for tension control. Conveyors with counterbalanced pressure roll.
processing equipment	Cooling and polishing rolls. Laminators for web widths to 96" with unwind and rewind stations. Pelletizers.
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the aspect of threat but the conception of a blessing calls for top management to devote a disproportionate amount of its time to a lusty youngster.

Reinforced plastics pipe and fittings manufacturing and marketing is truly a diversification and not a branch operation of the present businesses. Unfortunately, the history of diversified operations is too often that of sad neglect. Much of the speed with which pipe marketing grows will be determined by how this diversification is handled.

The present facilities are also essentially short line manufacturing and marketing operations. This adds a heavy proportion to the cost of production and promotion, hence to the cost of the goods sold, which in turn limits the market. This circle works favorably in reverse, but it requires bold investing to push an operation into orbit as early as possible.

In the long run, with a high proportionate cost of raw materials in pipe and fittings, we are led to the conclusion that integrated production of raw materials and the end product awaits only volume and imagination matched with capital. The projected 1960 volume will make integration economically sound. The prize then is likely to go to the organization who takes this total step. 3M is perhaps closer on this score than the other producers at this particular time.

In any event, reinforced plastics pipe may be expected to become a major material in the market place by 1965. Tanks, process vessels, and other structurals go along with pipe and should be included in the product line, thereby making the broadest use of hard won know-how. Even extruded pipe is a likely partner since it is not too essentially competitive, yet the same customers have suitable needs for both products. The industrial sales of such a range of goods relates to a common sales engineering and engineering design base.

In summation, I visualize a Plastics Company or Companies of America in the making, paralleling the history of the aluminum industry with equal success and in due time equal in size.—END

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NOTE: You can get the unusual qualities of ATLAC 382 in ready-to-mold form with our THERMAFLOW® reinforced molding compounds . . . based on this *different* polyester.

Acrylic sirup

(*From pp.* 109-112)

rigidity so that they can be removed from the press as soon as cure is complete.

Premix

Limited work has shown that, as in the case of polyester resin, acrylic sirup can be compounded into "premix" or "gunk" molding compounds. Initiators, fillers, pigments, and reinforcements of short glass, sisal, or synthetic fibers are mixed with resin before charging to the press. A typical compound might contain 20 to 30% of resin and have a putty-like consistency; it should be kept in closed containers to prevent loss of monomer. It is shaped and cured in heated metal molds.

From the work done it appears that acrylic sirup can be handled about the same as polyester. Premix moldings generally are characterized by lower physical strength than moldings made with mat or preform. These compounds also shrink less during molding.

Costs

While field experience with molding reinforced acrylic sirups has not been extensive so far, there are good indications that these laminates will cost about the same to make as do equivalent polyester laminates. At least one experienced molder has found that reinforced moldings made with acrylic sirup have fewer defects—bubbles, pinholes, etc., and are less subject to crazing. These factors, which mean fewer rejects, may result in savings that more than offset a slightly higher material cost. However, considerably more experience will be required before a definitive picture on costs can be drawn.

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Polyethylene sheet

(*From pp.* 113-120)

so that no part of the sheet can "see" a cold surface.

While total heating time required is increased as sheet thickness increases, the increase in heating time is not directly proportional to the change in thickness. To illustrate, display racks (Fig. 3) were made from 20-, 60-, and 100-mil sheets of the same polyethylene resin. For each sheet thickness the forming unit was operated on a semi-automatic cycle and the heat timer setting was reduced stepwise until the sheet tore repeatedly on being draped over the mold. The time was then increased in 1-sec. steps until the sheet would consistently form without tearing. Table I, p. 120, lists this minimum heating time for each sheet thickness.

For thicker sheet, the heating time per unit of thickness is lower than that for thin sheet. This is largely due to the fact that the surface-to-volume ratio is lower and the heat lost to convection currents across the sheet surface represents a smaller percentage of the heat being put into the sheet.

The final sheet temperature required for forming a given sheet is influenced by a number of factors. Forming temperature increases with an increase in depth of draw, with a decrease in melt index of the resin, where fine detail in the mold is to be reproduced accurately, or when the mold is operated at a low temperature. Resin density is an important factor. For the display rack, sheet of 0.914 density could be formed at 225° F. while 250° F. was required to form sheet of 0.930 density.

It should be noted that the above comments on heating apply to resin of natural color. Heating rates for pigmented sheet are likely to be higher, the size of the difference being dependent on the amount and type of pigmentation.

Cooling: With respect to cooling sheet after forming, there are three minor differences between polyethylene and other forming resins. First, polyethylene con-

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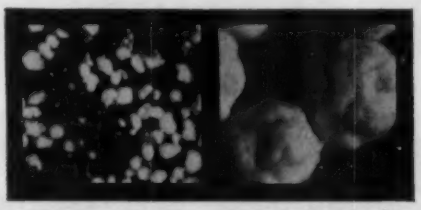

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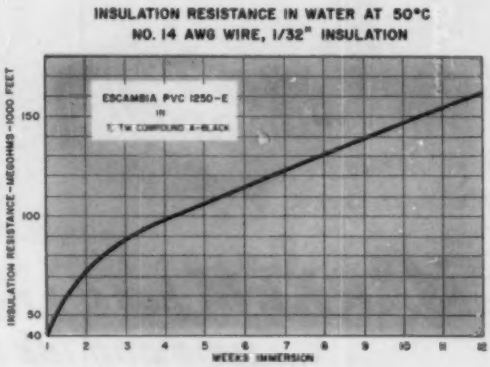

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ducts heat faster than other forming resins. Thus, heat from polyethylene sheet is transferred to the mold more rapidly and the effect is to reduce the time required for cooling. Second, polyethylene has a higher specific heat than do other forming resins; thus more heat must be put into the sheet to soften it and more heat must be removed after forming. The effect is to increase time required for both heating and cooling. Third, the stiffness of polyethylene is low at high temperatures. In some, but not all cases, it may be necessary to cool polyethylene to a relatively low temperature before stripping from the mold. This requires more cooling time.

Provision for control of mold temperature is an effective and simple solution to the problem of cooling formed sheet rapidly. Control of mold temperature also eliminates the opposite extremes of chill marks on the sheet caused by contact with a cold mold or having the sheet stick to an overheated mold. The following data for a display rack, drape-formed over a mold equipped with a temperature control coil, show typical cooling times for Alathon 31. With the mold at 120° F., the 20-mil-thick shape was cooled in 7 seconds. Raising mold temperature to 190° F. increased cooling time to 8 seconds. In each case, the display rack was cooled only enough so that it was not distorted on being stripped off the mold. With the mold temperature below 120° F., chill marks were seen on the sheet while 190° F. is near the upper limit for rapid cooling.

Conclusion

The unique combination of end-use properties and processing characteristics which can be designed into polyethylene resin promise an excellent future for this resin in thermoformed products. Progress is dependent on development work in the areas of end-use testing, processing techniques, and resin characteristics. Rapid heating and cooling of polyethylene sheet are easily accomplished with high heater densities and controlled-temperature molds.—END

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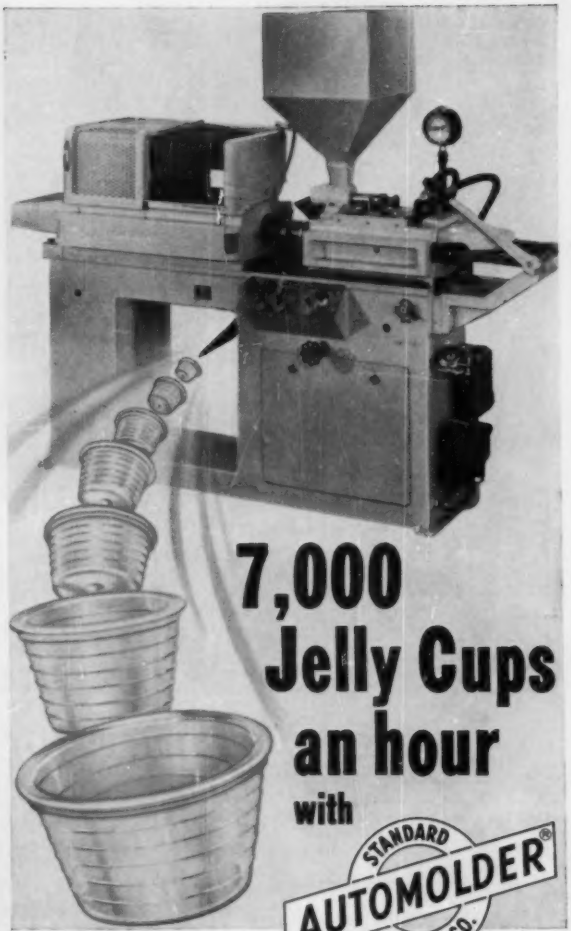

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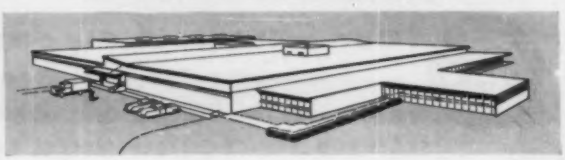

Carbon black

(*From pp.* 125-130)

tween this pigment and surrounding plastic for the pigment particles to become visible in the electron micrograph. By the use of special techniques, V. G. Peck and J. B. Davis, of our laboratories, have been able to make reasonably good pictures of the "background" dispersion. Cases can readily be imagined in which good low-power dispersions could show poor background dispersions and vice versa. In such cases it is believed that the background dispersion should give the more reliable prediction of weatherability.

Conclusions

Pending further weathering data, it seems reasonable to conclude that a carefully standardized absorptivity measurement at a fixed film thickness with white light can give a useful prediction of the weatherability of polyethylene pigmented with carbon black. It is also concluded that the best dispersions of carbon black in polyethylene presently available are probably about as good as can be made, since their absorptivity equals that of evaporated carbon films.

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Behavior of PVC pipe

(*From pp.* 132-139)

Therefore, the span length is given by the equation

$$L = \frac{12\,\sigma_{max.}}{W}\,(I/c) \qquad \text{Eq. 42}$$

Suppose the problem involves a length of 2-in. Schedule 80 PVC pipe holding water at 50 p.s.i. at room temperature: it is desired to examine the stress and deflection at 10,000 hr. of service and determine a suitable span length for the pipe supports. It is assumed that there are no wind loads and that PVC has an initial elastic modulus of 450,000 p.s.i. The 2-in. pipe with water has a unit weight of 0.194 lb. and is stressed as follows:

$$\sigma_h = pd_i/2t \qquad \text{Eq. 43}$$

$$\sigma_r = -p_{(i.\,p.)} \text{ and } O_{(o.\,p.)} \qquad \text{Eq. 44}$$

$$\sigma_z = M_{max.}\,c/I + pd_i/4t \qquad \text{Eq. 45}$$

From Eqs. 43-45 and 23 it is concluded that the approximate "equivalent" wall stresses are those which are given in Table IV, p. 139.

From Fig. 6 it is concluded that stress-rupture is not likely even for 15-ft. spans at room temperature (73° F.). However, using the conventional factor of safety of 4.0, the maximum design stress would be 2,960 p.s.i., which is still below the actual expected rupture stress for PVC. It is concluded, therefore, that even for 15-ft. spans a safe design could be effected based on stress alone. Now consider creep. The elastic deflection is given by the relationship

$$\delta_{max.} = \frac{WL^3}{384E_0I} \qquad \text{Eq. 46}$$

Values calculated from Eq. 49 for the present example are given in Table V, p. 139.

Now to determine the creep deflections we use the appropriate values of σ_0/σ from Fig. 8 in Equation 15 which gives the results of the third column in Table V.

Thus from the above tabulation, if we want to keep the total deflection down to, say, ¼ in., we would not want to use a span length for the conditions imposed of about 6 to 8 feet.—END

The Plastiscope

News and interpretations of the news
By R. L. Van Boskirk

Section 2 (*Section 1 starts on p. 37*)

Film sparkles at Packaging Show

The battle for film markets that is now brewing in these United States of America is going to produce as spectacular a struggle for dollars and products as any conflict ever waged on the business battle front. At least that is the opinion of more than one observer who attempted to fathom the meaning of all the claims made by film producers and converters at the recent packaging exposition.

New uses for the older films—cellophane, cellulosics, saran, Pliofilm, vinyl chloride, and conventional polyethylene—are still being sought in order to broaden the market; but the competition is being heightened by a constant infiltration of new or comparatively new films, such as several varieties of polyesters, low-pressure-processed polyethylene, polypropylene, and polystyrene. And some that have been around for a comparatively long time, such as nylon and unplasticized vinyl chloride, are still nipping at the fringes with the possibility of a major breakthrough at any time. In addition, there is a growing interest in combinations of films as well as coatings of various types that may be applied to film, paper, and foil.

Polyethylene on top. However, major interest at the exposition seemed to be in polyethylene (called p.e. in this article from here on) of both the high- and low-pressure-processed types, the latter of which may be designated as either linear or high-density.

Considerable attention was focused on a 10-mil p.e. bag to replace conventional multi-wall paper bags for shipping resins, fertilizers, stock feed, and other hygroscopic materials. The resin from which this film is extruded has a density of 0.917 and a melt index of 4, and the bag costs from 20 to 30 cents. But even though initial cost may be higher than paper, this factor is more than canceled out because there is less damage in shipment, the bag and contents may be temporarily stored outdoors without damage to contents, its light weight saves dollars per load, it is resistant to chemicals, the contents can be seen, and the bags can be reused.

Some of the potential markets for this type of bag are fertilizers with 500 million bags a year; plastics, 65 million; commercial feeds, 600 million; bulk detergents, 8 million; powdered milk, 35 million; quick lime, 150 million; insecticides, 20 million; and many lesser items such as sulfur, dog food, seed corn, peat moss, and many others. If this application goes over big, there will be a tremendous amount of scrap material around, but the farmer will get a dollar or two refund on every ton of fertilizer he buys when he sells the empty sacks.

Cast p.e. film. Another development which was enthusiastically shown by one producer was cast p.e. film. He asserted that when p.e. is cast from an extruder onto a chrome plated chilled roll, all surface unevenness is removed and optimum "see-through" is obtained. However, some strength must be sacrificed if optimum clarity is to be obtained. The resin used is of 0.929 density with melt index of 5, which is higher than that ordinarily used for film. The casting is done on coating equipment used by processors now coating p.e. on paper and thus presents the possibility of making film producers out of paper coaters.

Another producer showed that extrusion-blown p.e. film could be drawn down to $\frac{3}{10}$ mil. So far there is no practical use for such thin film, but the idea was to indicate that high-pressure-processed resin can be used for producing usable film with thicknesses under the more commonly used 1- and 1½-mil gages.

Wrapping material. A highly significant feature of the exposition was the evidence that p.e. film will soon become a wrapping material. Up to now, its use for wrapping has been limited because of difficulty in handling on a wrapping machine. When p.e. is accepted on a broad scale as a wrapper, its potential market will be increased by hundreds of millions of pounds.

One example of p.e.'s use in this form was as a bread wrap. (See also "The polyethylene bread wrap," MODERN PLASTICS 35, 118, June 1958.) There were two samples at the show. One was standard 1½-mil p.e. with polyethylene-wax paper adhered to each end so it could be pulled through the wrapping machine and sealed by conventional methods. The other was ½-mil medium-density film, of something over 0.930, with paper outserts on each end. The higher density gives more stiffness for easier handling on the wrapping machine. Bread wrapping alone could increase p.e. film production by over 100 million lb. a year if these developments prove successful.

One exhibitor concentrated on the advantage of linear p.e. as a wrapper with the particular advantage of easy opening since orientation of the film will permit a "built-in" tear tape that will permit opening on a printed line, and the stiffness of linear film will permit handling on wrapping machines. He foresees its use for wrapping toilet tissue, men's shirts, breakfast food, paper napkins, and cigarettes at savings of from 10 to 44% over cellophane and 10 to 13% over conventional

* Reg. U.S. Pat. Off.

p.e., depending upon the commodity to be wrapped. He stated that the cigarette industry may save $6 million a year when it finds a way to adopt linear p.e. (Other methods of making polyethylene packages easier to open are described on p. 180 of this issue.)

Irregular-shaped packages. Other evidence to show the swing toward p.e. film was a machine for retailers to package irregular-shaped produce in p.e., costing less than $1000; an improved machine for enveloping dry-cleaned garments where the p.e. comes off a roll like paper and is sealed and cut by pressing a food pedal; an adhesive tape that permits printers to handle and adhere rubber plates without "sticky" problems; a packing kit that carries metal bearings in oil; an extruded film with solid color strips as an integral part of the material; and ever-increasing uses for all sorts of bag packaging.

And to cap off the tremendous usefulness of p.e. film from a properties point of view was a big sign by one exhibitor that said "516 sq. in. for 1¢" which emphasized what is perhaps the most important property.

Typical coating and laminating applications for p.e. included a p.e.-paper combination for ice cream containers; a coating over foil for petroleum jelly and gauze dressings and on cellophane for cheese; and a one-shot container for catsup with p.e. over foil. A newer one was p.e. on Sanforized paper to give stretch for bags, pouches, and tubes.

The coating category also works in reverse, notably the use of polyethylene and saran polymer on cellophane for meat. Some types will permit entrance of oxygen and thus make them available for fresh meat wrapping since oxygen is required to prevent meat from turning black. In this coating category could be placed the p.e. and Mylar combination for packaging precooked foods and a new combination of the same materials for skin packaging, which at 1-mil thickness is claimed to be as efficient at a cost of 15¢ per 1000 sq. in. as 5-mil acetate at 19 cents.

Mylar at work. Another use for Mylar, aside from the above and its now well known use as a window box and container for heavy items, was as a ½-mil laminate with a pressure-sensitive adhesive to use as a surface for fiberboard beer cases where it is now competing with vinyl-acetate coating. Both types of surfacing increase the number of times a beer case may be used by manyfold, but the more costly Mylar is claimed to last much longer and thus make less replacement necessary. There is also a good possibility that the Mylar laminate may prove highly practical as a laminate on six-pack cartons for beer and soft drink bottles.

Acetate and butyrate film and sheet enjoyed their usual prominence at a packaging show with ever-increasing volume in the customary applications for window envelopes and visible packaging; but the use that caught the eye of most visitors was automatic blister packaging.

There is now apparent a swing from skin to blister packaging after a short predominance of the skin-type method. The development of machines for automatic blister packaging will no doubt increase this trend. An estimated 3 million lb. of acetate and butyrate were used for skin and blister packaging in 1957, but volume could be increased considerably if automation takes over. Up to now, most blister and film packaging has been in cellulosics, but cast vinyl has moved into the field for heavier items such as hardware and there is also the p.e.-Mylar combination mentioned above.

However, since an automatic blister pack installation costs from $40,000 to $50,000 and requires molds and expert handling, its use will probably be confined to large companies such as automotive concerns which have one item such as spark plugs that are produced in millions of units. Small light bulbs, razor blades, and spools of thread are other examples. A machinery producer stated that automation-happy engineers will no doubt go crazy over this development just as they did over the "extruder-to-end-product" projects; but he doubts that either of these mass production systems will take much business away from the smaller, independent thermoformer for the reasons stated above.

A variation of an older film was a new Pliofilm (hydrolized rubber) formulation produced in 0.0008-in. thickness which was built to compete with 1.1-mil cellophane and enter the battle for meat wrapping films. The new formulation is breathable and thus available for fresh red meats. The older formulations of Pliofilm have been used for several years to wrap processed meats to prevent shrinkage and loss of flavor. Another unique Pliofilm application was a laminate with paper and foil for packaging putty to keep it from drying out.

Plasticized extruded vinyl film of fine clarity has moved into a contending position as a wrapper for paper products, for stockings, and window boxes. A copolymer of vinyl and acrylonitrile is still battling to hold a share of the processed meat markets. Unplasticized vinyl film is still a stranger to American packaging shows, but sheeting was displayed to some extent for thermoformed containers and an Italian import now distributed in this country was a rigid vinyl sheet for packaging fresh fruit in a protective shell. The vinyl plastisol jacket for bottles introduced two years ago is apparently growing at a good rate.

Use of saran is growing from year to year but mostly in applications that began some years ago, such as bags for processed meat, candy, and cheese, and a modified saran in shrinkable form continues to increase in volume for poultry wrapping.

New films shown at the show

U.S.I.

Vol. III, No. 4

POLYETHYLENE PROCESSING TIPS

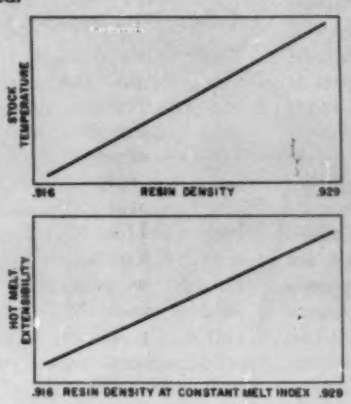
HOW RESIN DENSITY AFFECTS FILM PROPERTIES, EXTRUSION CONDITIONS

Extruders of blown or flat film will find, in working with some of the newer polyethylene resins of about .93 density, that they are significantly different from the more conventional resins of about .92 density — both in behavior during processing and in properties of the final film.

Operating Temperatures and Speeds Rise

As resin density increases from .916 to .930, higher stock temperatures are required — ranging from zero to 30°F higher, depending on the resin. At the same time, blown film does not have to be cooled as much. Since the higher density resins have a harder surface, are less tacky, and do not block readily, the temperature of a film of .930 density resin can be 10-20°F higher at the nip rolls of the take-up without introducing internal blocking.

The higher film temperatures at the pinch rolls help prevent wind-up wrinkling to which higher density films are susceptible (see U.S.I. Polyethylene Processing Tips, Vol. III, No. 3). Less cooling means faster production using higher density resins, and is also advantageous where space for cooling equipment is limited.



It should be remembered, in processing higher density resins, that the resulting films have lower impact strength than do films from lower density resins. Therefore, excessive roll pressures in blown film wind-up should be avoided, to prevent too sharp a crease in the flattened film cylinder, particularly in gussetted film. A sharp crease, when subjected to impact loading during film use, will frequently fail by tearing.

Also, as density increases from .916 to .930, resins have better hot melt extensibility — can be drawn down to thinner gauges. U.S.I.'s .929 density resin, for example, has been drawn down to less than 0.2 mils thickness in a regular production run.

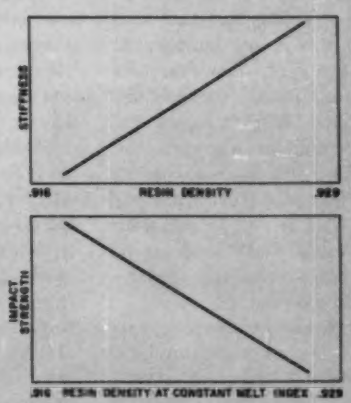
Films are Stiffer, Easier to Handle: Seal Hotter

Films extruded from higher density resins have more body and less stretch than do those made from conventional resins. This means that they are easier to handle on standard converting equipment and can be more easily used on high-speed converting and packaging machinery.

In heat sealing, as in extrusion, slightly higher temperatures must be used to effect a satisfactory seal with the higher density resins.

Clarity Up, Impact Strength Down

At resin densities of about .93, films are clearer, have less haze, higher gloss, greater transparency. They are stiffer, with more tensile strength, but have lower impact tear and impact strengths. Because they have harder surfaces, they are more abrasion-resistant. Heat resistance also increases. Permeability goes down (see U.S.I. Polyethylene Processing Tips, Vol. II, No. 2).



As you can see, the extruder's choice of resin density will depend largely on the film properties desired by his customer. For toughness, flexibility and good protection, low densities are indicated. For more stiffness, clarity and heat resistance, higher densities are coming into prominence.

U.S.I. offers a series of polyethylene resins, ranging in density from .916 to .929. U.S.I. technical service engineers can recommend the proper resin with the best balance of properties for your particular application. They will be glad to work with extruders and converters on processing problems as well.

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The Plastiscope

were polystyrene, polypropylene, and the new Videne polyester for stretch laminating. All are too new for extensive display of applications now in use.

The 1- and 2-mil polystyrene film, notable for low cost, sparkle, crispness and clarity, and for use in window boxes, bags for paper goods, and wearing apparel, was described in this column last month.

Videne polyester film for stretch laminating, whereby a 4-mil film can be drawn down to a ¼-mil coating over paper, leather, impact styrene, aluminum, and other sub-strata was described in an article in MODERN PLASTICS 35, 94, March 1958.

Biaxially oriented polypropylene was on display, but the exhibitor declared commercial production was a long way off and that price would be comparable to polyester film. However, he qualified that price comment by showing how 1000 sq. in. of ½-mil polypropylene film can be sold for 4.5 cents. Because of its low density (about 0.890), it gives over 61,000 sq. in./lb. In addition, it is not likely that the price of polypropylene resin will always be over 50¢ a pound.

It is also known that there will be many types of polypropylene film and the unoriented, amorphous type extruded from a straight die will probably be less costly than biaxially oriented material and suitable for many varieties of packaging applications.

Other plastics. There were, of course, many types of plastics shown at the exposition aside from film and coated materials. According to one estimator, more than $4 million worth of plastics materials was used for packages last year, mostly as self-service "show cases" for food and household items, but limited space forbids a detailed accounting in this column.

Some of the highlights were 16-oz. bottles made of linear p.e.; collapsible tubes made of conventional p.e., with caps of the same diameter as the tube, and with printing "upside down" so that the tubes can be stood upright on the retailer's shelf to save space and the printing easily read; roll-on p.e. bottles with a round cap or valve that prevents leakage; tiny p.e. tubes with ⅜ oz. of shave cream to pack with a razor in a 25¢ one-shot job for a vending machine.

There were no signs of any great swing to linear p.e. sheeting for vacuum forming, but an experienced veteran in vacuum-forming explained that this situation would change for the better just as soon as users could obtain deliveries of more uniform quality. Variations result in problems of gage tolerance, strain control, and surface finish on heavy gage sheeting. He said that calendering shows good possibilities in helping to obtain a more uniform sheet.

Molded polystyrene containers and lids from oriented sheeting, impact material, and general-purpose material were present at the show in great quantity, especially thin-wall and throw-away items. A ½-gal. ice cream container gave evidence that polystyrene is out to enlarge its portion of this big market where various plastics are vying for dominance. A polystyrene container in which hot hamburgers can compete with hot dogs at ball games and other public gatherings also aroused considerable attention. Molded polystyrene foam for packaging fragile items showed still another variation of styrene's utility.

The resin adhesive situation is more or less obscure at a packaging show since its use is covered up; but without adhesives the packaging business would be like a wagon with a missing wheel. The part that resins have played in advancing the adhesive business with odorless, mold-free, and non-toxic materials that have built-in heat and moisture stability is a story in itself that can't be covered here.

Vinyl-acetate resins alone were probably involved in the formulations of every adhesive producer at the show. Vinyl ethers and epoxies, too, are beginning to show up in solid film glues that can be applied by simple pressure. And one producer is now marketing a $38.50 hand applicator for said glue in tape form which makes application as simple as using a hand roller.

Among other highlight adhesive innovations were invisible coatings on corrugated board to prevent slipping of boxes; a primer for adhesives for particular use with plastics; an improved casein labeling glue that is iceproof and water resistant; and a granular form hot melt for p.e., foil, and other impervious surfaces to be fed into an extruder and then forced on the feed stock. This system eliminates need for premelt equipment and the glue can be left in the extruder from one work period to the next without clean-up. One firm states that the company now produces 300 adhesives for transparent films compared with 50 only five years ago.

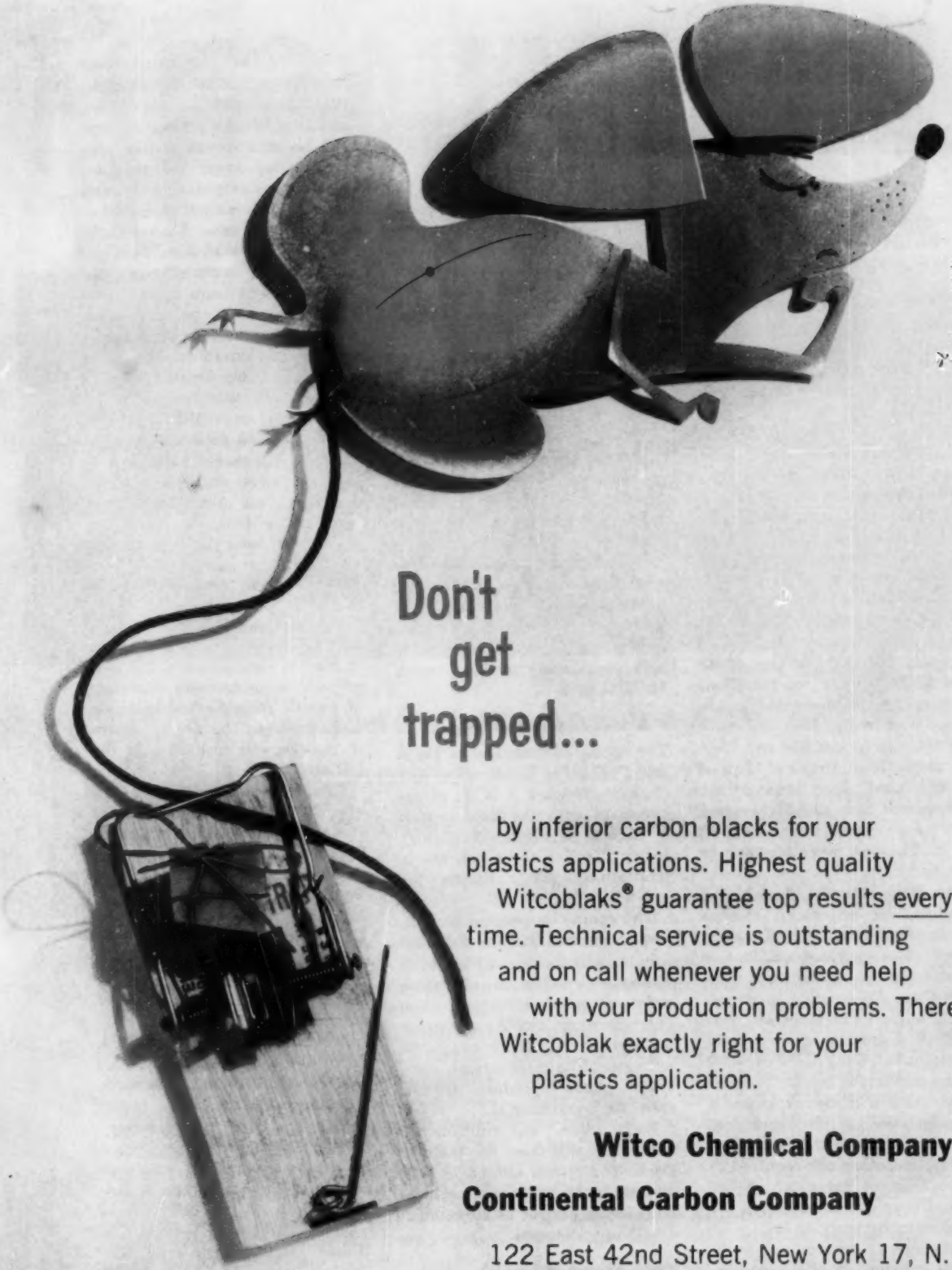
Reinforced plastics 10% ahead

The reinforced plastics business through April was approximately 10% ahead of the same period last year, according to A. W. Levenhagen, president of Molded Fiber Glass Tray Co., Linesville, Pa.

In assuming office as general chairman of the Reinforced Plastics Div. of The Society of the Plastics Industry, Inc. for the coming year, Mr. Levenhagen said that producers of glass fiber reinforcement report that although their production facilities are working to full capacity, some extensions of normal delivery schedules were necessary.

Boats and building panels are leading the industry to higher levels this year. One source estimated that sales to the boating industry through May are 45% ahead of last year's record sales of 50,000 units. School seating is another market for reinforced plastics that has not felt the effects of the business recession.

The industry's 10% gain over



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1957 has been achieved in the face of depressed automobile sales, which last year accounted for 20% of the industry's business.

PVA moves to broaden markets

Reductions in the price of polyvinyl alcohol and an expansion of PVA production capacities reflect a broadening of markets for this resin.

Colton Chemical Co., Div. of Air Reduction Co., Inc., Cleveland, Ohio, reduced the prices of Vinol polyvinyl alcohol from 3 to 15%, depending on the grades and quantities ordered. Du Pont had already reduced the prices of five major grades of Elvanol PVA. Elvanol 72-60, used primarily for adhesives, paper sizes, and textile sizes, now costs 57¢/lb.; it was formerly 67 cents. Elvanol 50-42 and 52-22, used in the manufacture of polyvinyl acetate emulsions, were reduced 5¢/lb., making the new prices 83¢ and 75¢/lb., respectively. Prices of Elvanol 71-30, used for unsupported transparent film, and 51-05, used for textile sizes, were dropped 3¢/lb. The new price for both is 64¢/lb.

Air Reduction Co., Inc. is expanding its polyvinyl alcohol production capacities by building a new chemical plant and an extensive pilot plant facility at Calvert City, Ky., costing in excess of $12 million. The plant will produce 20 million lb. of PVA resin annually. Doubling of the capacity of the existing 45 million lb./year vinyl acetate monomer plant is also included in the expansion, since approximately 2 lb. of vinyl acetate monomer are required to make 1 lb. of polyvinyl alcohol resin. The plant is scheduled for completion by early 1960.

In addition, the company will build an extensive pilot plant facility at Bound Brook, N. J., which will be used in support of the production and sale of polyvinyl alcohol.

Existing uses for polyvinyl alcohol in this country are in the preparation of adhesives, textile sizing and finishes, paper coatings, and as emulsifying and thickening agents. A special form is also used as a starting material in the production of polyvinyl butyral, which is the plastics interlayer for automobile safety glass. In Japan, the resin is used in the production of vinylon, a synthetic fiber developed by Kurashiki Rayon Co., Ltd., Osaka, and Air Reduction has been granted the U. S. rights to the vinylon fiber process. According to John A. Hill, president of Air Reduction, the development of this fiber possibly may best be accomplished in cooperation with others having experience and position in the textile field. Discussions with prospective partners are already well advanced, Mr. Hill said.

Plastics technology courses

The Special Courses Div. of Newark College of Engineering, 367 High St., Newark 2, N. J., in cooperation with the local section of Society of Plastics Engineers, Inc., will offer three courses in plastics technology during the 1958 fall term.

The course on process properties of plastics, starting September 11, will include a history of plastics, classification of materials, chemical structure, flow characteristics, etc. Also starting on September 11 is the course on extrusion. The third course, covering plastic product design, starts on September 15.

Each course will run for 12 weeks and will meet one night a week. The course offered by the division may be taken individually or as part of an integrated Certificate Program.

Navy orders 50 miles of PVC pipe

Probably the largest single order for heavy-walled rigid polyvinyl chloride pipe ever placed in the United States has been placed with Alpha Plastics, Inc., Livingston, N. J., by the United States Navy. More than 50 miles of Alpha 102 high-impact 1-, 1¼-, 1½-, and 2-in. Schedule 120 PVC pipe will be used in above-deck seawater washdown systems designed to protect ships and crews under atomic attack from radioactive fallout. (See "Shower baths for warships," MODERN PLASTICS *34*, 129, Oct. 1956) The system covers the ship with a continuous spray of seawater which washes radioactive particles overboard. It will be used for vessels ranging from carriers and capital ships to transports and LSTs.

PVC pipe was specified for this application because of its light weight, resistance to corrosive seawater and weather, simple and secure method of assembly, nonflammability, and resistance to shock and impact.

First plastics engineering graduates

Eight men received the country's first bachelor of science degrees in plastics engineering at the 60th annual commencement exercises of Lowell Technological Institute, Lowell, Mass. The degree course in plastics was instituted in the fall of 1954.

Graduates entering the industry are C. William Rowntree, who joins American Cyanamid Co., Wallingford, Conn.; Victor W. Proulx, Koppers Co., Inc., Pittsburgh, Pa.; and Raymond W. Michaud, Improved Machinery Co., Nashua, N. H.

Alden R. Bratt and Raymond B. Sylvain, Jr. will enter military service. Robert H. Mack will pursue further study at Newark College of Engineering, Newark, N. J. Edward A. Buonopane and Gerald M. Meehan have not as yet made a definite selection.

Polyethylene coating

A new polyethylene extrusion coating resin for paper, cellophane, and foil has been developed by The Dow Chemical Co., Midland, Mich. The material, designated Dow polyethylene 610M, coating grade, has a melt index of 5 and is claimed to exhibit excellent draw-down which results in lower coating weights and increased economy.

According to the company, 610M

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has been applied with comparatively good adhesion in thicknesses as low as 0.2 mil and has been run experimentally down to 0.1 mil.

Dow also markets 700C, which has a higher melt index and is used primarily for heavy coatings. The firm also has three resins for wax modifications, designed to reduce flaking of wax coatings, increase their heat sealability, and improve their gloss and appearance.

Skin pack unit

A 3-in-1 coating-drying-scoring unit for making skin packs can now be installed in any plant, according to Skin-Pack, Inc., Chicago distributor for Abbott Plastic Machine Corp., 7124 N. Clark St., Chicago 26, Ill., manufacturer of the unit. Designated CDS, the machine handles 32-in. cardboard sheets and is claimed to be capable of keeping pace with all blister-pack and skin-pack operations, up to 900 sheets per hour.

The three steps involved, all of which are completely controlled by the automatic machines, are 1) hand feeding the sheets into the coater; 2) drying by special quartz intra-red heater; and 3) hand feeding into the scoring unit cylinder where the vacuum process forms a plastic skin pack. The unit is claimed to cut costs as much as 50 percent.

Plastics consultant

J. Harry Du Bois, Box 178, Montclair, N. J., has established consulting services for the plastics industry, specializing in marketing, product development and engineering, sales training, and management. Services will emphasize particularly the marketable applications for plastics materials in industry, and the development of marketing techniques.

Mr. Du Bois, a Plastic Pioneer and one-time president of Society of Plastics Engineers, Inc., has been associated with the plastics industry since 1928. His former affiliations were with General Electric Co., Shaw Insulator Co., Plax Corp., Mycalex Corp. of America, and Synthetic Mica Co.

Service for printed circuits

An engineering service for packaging electronic circuits from schematic diagram to the final printed circuit or modular form has been inaugurated by Arthur Ansley Mfg. Co., New Hope, Pa. The firm's printed circuit manufacturing facilities are available for making prototype boards to test the final design.

Polyester drink mixer

Much enthusiasm among molders and designers concerning Durez' colored polyester compound is reported by Hooker Chemical Corp. Electrical appliance handles and trays are among the first products to be given the polyester treatment. Biggest piece molded to date is the Waring Drink Mixer (Modern Plastics, February 1958, p. 98), which recently was switched to this new material.

Stripping solvent

Valuable parts, coated, cast, or molded in epoxy or polyester compounds, can be recovered with Isostrip 701, a fast acting stripping solvent available from Isochem Resins Corp., 221 Oak St., Providence 9, R. I. The product, claimed to be non-flammable, is a good solvent for other resins and may, therefore, attack wire coatings and other plastics parts.

Isostrip 701 weighs about 8 lb./gal. and is available in 1- and 5-gal. containers at $1.50/lb.

Diallyl phthalate in machinable stock

Engineers preparing prototypes made of diallyl phthalate can now obtain prototype blanks in machinable stock at cost from Mesa Plastics Co., 11751 Mississippi Ave., Los Angeles 25, Calif., before going to the expense of building dies.

Blanks are furnished in a wide variety of shapes and sizes and in all types of diallyl phthalate. The company states that the blanks are guaranteed free of voids, cracks, and porosities, thus insuring complete machinability to any configuration.

Nylon for large extrusions

A nylon compound developed for the extrusion of large shapes and designed to meet the needs for an ultra-high melt viscosity material has been announced by Plastics & Coal Chemicals Div., Allied Chemical Corp., 40 Rector St., New York 6, N. Y. Designated Plaskon Nylon Extrusion Compound 8205, the material has also been found particularly suited for blow molding of bottles and containers.

Because of the compound's stability, it can with proper handling, be re-extruded several times, since maintenance of melt viscosity through successive regrinds is one of its special characteristics, the company states. Nylon 8205 can be extruded at stock temperatures ranging from 450 to 550° F. It can be used directly from the container without drying because the material is packaged under inert gas.

It is expected that the material will find applications in structural shapes, in modernistic porch and recreational furniture, and in air and exhaust ducts for handling corrosive, poisonous, or solvent fumes.

Tubing and pipe applications include high-pressure hydraulic, lubricating, gasoline, and instrument air lines, pneumatic communication pipe (department stores), and anti-friction lines.

Plastic armor for metal

Tons of Koroseal polyvinyl chloride material, manufactured by B. F. Goodrich Industrial Products Co., Marietta, Ohio, are being used at the new aircraft plating plant at McClellan Air Force Base, Sacramento, Calif., to sheathe plant equipment against corrosive plating solutions and fumes that eat away metal.

The new plant will plate and anodize engine parts, landing gear, electronic parts, etc. Plating solutions to be used include chrome,

copper, brass, rhodium, indium, silver, and gold.

New England Lead Burning Co., San Leandro, Calif., lined and covered 135 tanks with flexible Koroseal sheet and fabricated necessary hoods and duct work from high-impact rigid Koroseal sheet. A ¼-in. sheet was used for all the hoods and part of the duct work.

Polyethylene design competition

The Plastics Div. of Imperial Chemical Industries, Ltd., London, England, is organizing an annual design competition for retail articles molded from Alkathene, the I.C.I. brand of polyethylene. A cash prize and miniature silver trophy will be awarded to the winning designer.

Any retail article which was not marketed before January 1, 1958 may be entered in the competition, which closes October 31, 1958. Molders may submit as many articles as they desire. Results of the competition will be announced in November and the awards presented early in December.

The panel of judges will include Paul Reilly, deputy director of the Council of Industrial Design; K. W. Luckhurst, secretary of the Royal Society of Arts; and J. V. Crossley, a director of I.C.I.'s Plastics Division.

Provides germicidal properties

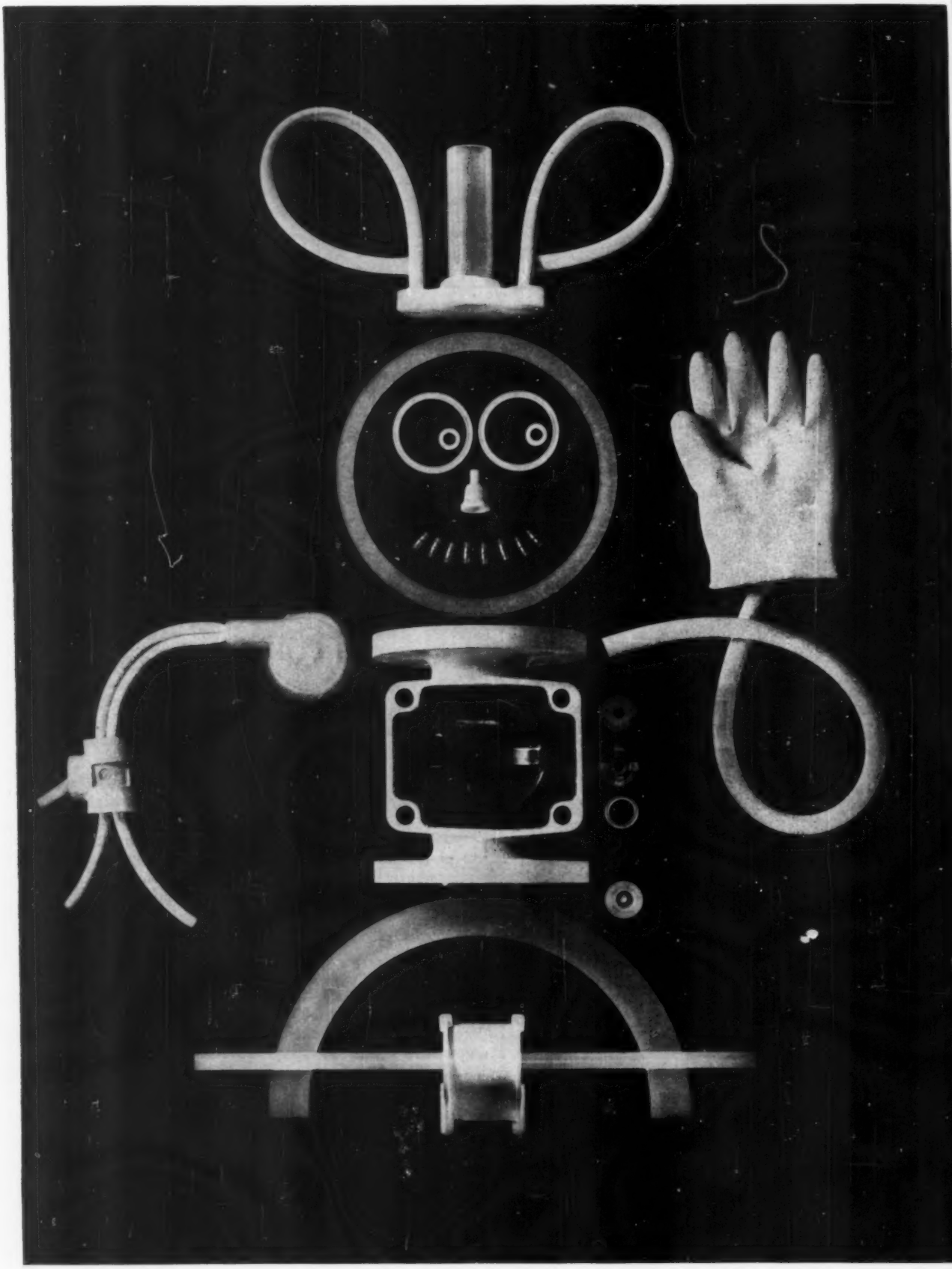
A concentrate, soluble in most plasticizers and said to provide superior germicidal properties to the finished product, is being marketed by Gallowhur Chemical Corp., Ossining, N. Y. Designated Puratized, the chemical is also reported to be self-deodorizing and mold resistant.

University correspondence course in plastics

Three units of university credits will be given by the University of California upon completion of the 30 writing assignments and the supervised final examination of its correspondence course in plastics.

The course — Engineering X 497ABC, Survey of Plastics—

(*To page* 216)



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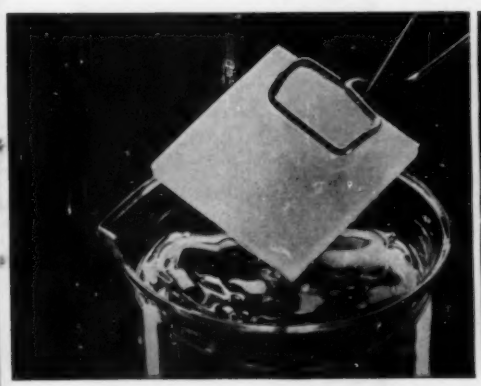

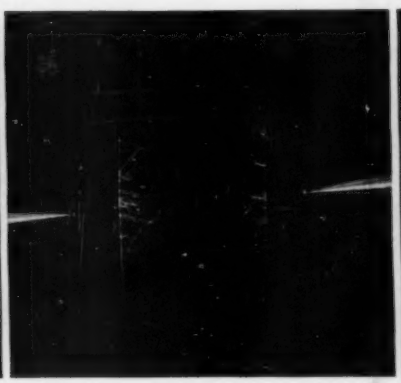

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covers the fundamentals and latest developments in the technology of the plastics industry. Special emphasis is placed on the applications of plastics, on their properties, on equipment, and on the latest molding techniques, according to the syllabus. The course also describes specialized processes, such as reinforced laminates, printed circuitry, potting, and encapsulation.

Enrollment fee, including the two-volume syllabus "Survey of Plastics" by Carl S. Seybold, Jr., is $40; out-of-state enrollees, $45. Those who do not wish to follow a formal plan of study may purchase the syllabus for $15.

Applications should be made to Department of Correspondence Instruction, University Extension, University of California, Berkeley 4, Calif.

Plastics Committee of MCA

R. A. Hoekelman, general manager of the Plastics and Resins Div. of American Cyanamid Co., was named chairman of the Plastics Committee of Manufacturing Chemists' Association, Inc. at the recent annual meeting of the Association at White Sulphur Springs, W. Va. He succeeds R. K. Mueller, vice president and general manager of Monsanto Chemical Co.'s Plastics Div., Springfield, Mass.

The Plastics Committee succeeded the old PMMA which was an independent organization until it became a division of MCA several years ago. Mr. Hoekelman presided at the Plastics Dinner, held at the Green Briar Hotel, and called particular attention to the committee's work in connection with Tariff regulations and promotion of the industry's activities in the building and construction field.

Flame-resistant fibre

A flame-resistant grade of vulcanized fibre is being offered by National Vulcanized Fibre Co., Wilmington, Del.

According to the company, the fibre does not support combustion when subjected to ASTM and Underwriters' Laboratory flame tests. Its flame resistance results from an additive that completely penetrates the material. This property can be built into any of National's standard grades of vulcanized fibre in the basic colors of black, gray, or red.

National points out that the new grade of fibre does not have the good electrical properties associated with standard vulcanized fibre, which is still recommended for applications where arc-resistance is required.

Wrapping machine for polyethylene

A versatile wrapping machine for weld-sealing unsupported polyethylene and other plastics films at speeds up to 75 packages per minute has been developed by Battle Creek Packaging Machines, Inc., Battle Creek, Mich. The machine will overwrap packages within the range of 4¾ to 12½ in. long, 3 to 8 in. wide, and ½ to 4½ in. high. Widths from 5 to 9 in. can be supplied on special order.

Battle Creek's new process, called thermo-pad sealing, combines heat and artificial refrigeration. The thermo-pads are attached to continuously moving chains which are timed with the package to apply the correct amount of heat, pressure, and cooling time to secure a tight seal in the finished package.

Conference on floor coverings

An interpretation of the values of seven types of resilient floor coverings in relation to appearance, comfort, and performance will be the subject of a conference to be held by the Building Research Institute on September 17 and 18 at the Sheraton-Park Hotel, Washington, D. C. Program and registration information may be obtained from Harold Horowitz, Building Research Institute, National Academy of Sciences, 2101 Constitution Ave., Washington 25, D. C. The BRI is a unit of the National Academy of Sciences.

The conference will study the returns of a survey sent to more than 7000 architects, home builders, general contractors, flooring contractors, lumber and building materials dealers, and building owners and operators. Returns show that serious trouble is being experienced with scratching and indentation, and flooring contractors are calling for a halt to the ease of maintenance claims made by manufacturers of certain types of tile.

Stocks acrylic sheets

Extruded sheets made from Implex A, Rohm & Haas' high-impact modified acrylic resin, are now available from Cadillac Plastic & Chemical Co., 15111 Second, Detroit 3, Mich.

Applications for Implex A sheets include housings, tote trays, machine parts, table tops, luggage, and parts exposed to continuous or intermittent contact with water.

Implex A is being furnished in gages from 0.060 to 0.125 in. in standard sizes from 48 by 50 to 50 by 96 inches. The sheets are stocked in natural off-white color; other opaque colors can be supplied on special order.

Custom-sized polyethylene sheet

Low-pressure-processed polyethylene has been added to its line of extruded thermoplastic sheet by Midwest Plastic Products Co., 1801 Chicago Rd., Chicago Heights, Ill. Called Midlon LP, the material is available in widths up to 40 in., in sheets 0.010 to 0.150 in. thick and in rolls up to 0.040 in. thick, custom-cut to requirements specified by individual customers.

Midlon LP is claimed to withstand prolonged and repeated exposures to live steam under pressure.

Spencer centralizes sales abroad

Foreign trade operations of Spencer Chemical Co. have been centralized through the formation of Spencer Chemical International, Inc., a wholly-owned subsidiary. The new organization, incorporated in the Republic of Panama,

"WE DIDN'T HAVE TO BUY OUR FOURTH NRC VACUUM COATER

Thanks to the new NRC Mechanically Refrigerated Cold Trap"

. . . *says Jack Selsemeyer*
Production Manager, Kent Plastic Corporation
Evansville, Indiana

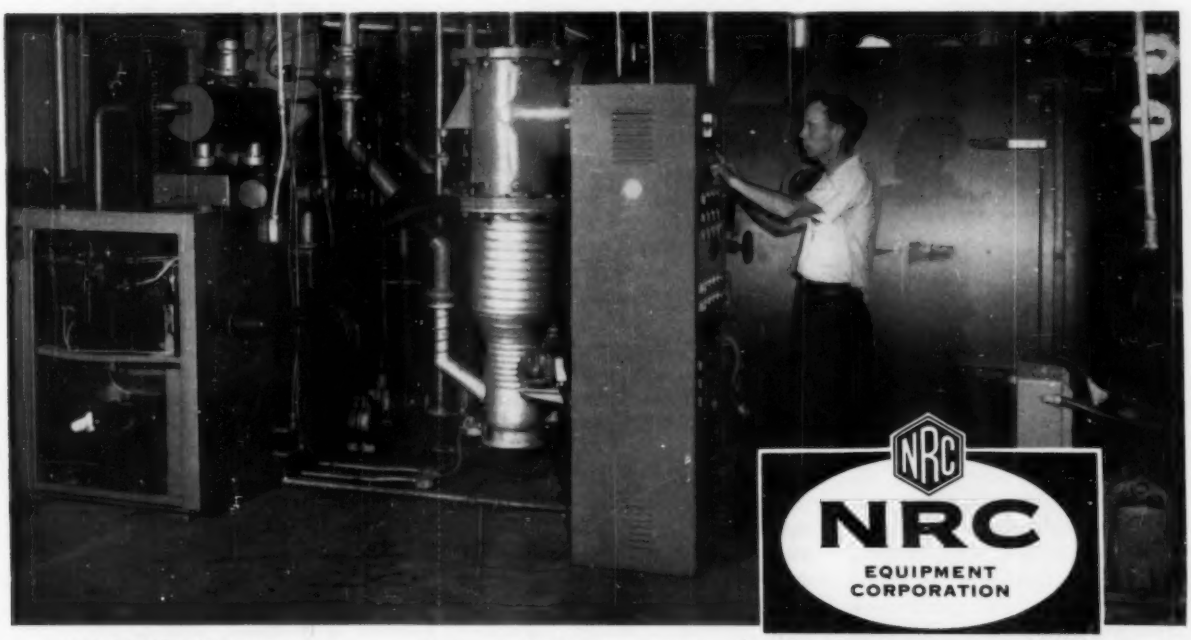
"In the spring of 1957 we decided to buy our fourth NRC vacuum coater. With the increased demand for our vacuum metallized plastic medallions and nameplates, that was the only way we knew of getting through the dread summer months without sacrificing the top quality and prompt delivery on which we've built our business. Summer's always been tough because the high humidity has caused our metallizing cycles to triple and our reject rates to rise.

"We'd already placed the order for the fourth coater, when NRC engineers introduced us to the new mechanically refrigerated cold trap. At first we were skeptical, because we knew other attempts to solve the humidity problems with cold traps had proven expensive and ineffective. However, the ability of the NRC mechanical refrigerator to maintain the cold trap at −150°F, and the special design features of the latter made us decide to try it on one coater.

"Results were spectacular. Production rates and rejects were almost independent of humidity, so that our hot weather costs are way down and we've got a competitive advantage in being able to make good on deliveries. Unfortunately for NRC, after we installed similar systems on our other two coaters we had so much more usable summer capacity that we didn't need the fourth coater."

The NRC Mechanically Refrigerated Cold Trap Assembly consists of a special refrigerator and one or more copper coils flange mounted for positioning directly above each diffusion pump. It offsets high humidity by freezing out water vapors before they can add to the load on the diffusion pumps. The assembly is easily installed in coaters equipped with NRC pumping systems and is simply modified for other equipment. The standard 4 HP refrigerator will maintain two traps at −150°F, the temperature found most effective for coaters operating at the usual 0.5 microns pressure. More powerful refrigerators are available for coaters operating at lower pressures or equipped with more than two diffusion pumps.

This development is the latest of the many contributions which NRC has made to profitable metallizing. If you now operate or are considering the purchase of a vacuum coater, it will pay you to ask your nearest NRC sales engineer for full details on how you profit from these contributions. Write or phone today.



SALES OFFICES: Atlanta • Boston • Chicago • Cleveland • Houston
Los Angeles • New York • Palo Alto • Pittsburgh

NRC EQUIPMENT CORPORATION
Dept. 19-V, 160 Charlemont Street
Newton 61, Massachusetts

The Plastiscope

will conduct worldwide sales operations involving all exportable Spencer products not covered by existing sales contract.

Officers of the new company are: G. Maynard Jenkins, president; he was formerly head of the parent company's Foreign Dept. J. E. Culpepper and Albert Slingerland, vice presidents; and Richard Cahill, secretary and treasurer, will manage the central offices in Panama City.

Product design course

The Industries Training School, Stevens Institute of Technology, Hoboken, N. J., will offer a new course entitled "Plastic Product Design" during the fall semester, starting September 25, 1958 and ending January 29, 1959.

The course will cover structural, chemical, and electrical properties of thermoplastic and thermosetting plastics, as well as design factors such as moldability, fabrication limitations, dimensional stability, low- and high-temperature effects, compatibility, and aging effects.

The plastics course is open to high school graduates or men with equivalent experience. Tuition is $50, plus a $5 registration fee.

Teaching the course will be Allen Shibley, a project engineer in the Ordnance Plastics Laboratory at Picatinny Arsenal.

Filler for PVC resins

A low-cost grade of dense-type precipitated calcium carbonate, claimed to be fully adaptable for use as a filler for PVC resins, has been introduced by Diamond Alkali Co., Cleveland, Ohio.

Tradenamed Carbium, the product is said to meet all requirements of uniformity, processability, and color stability in all polyvinyl chloride applications where these factors are principal considerations. Such applications include extruded and calendered stocks, floor tile, plastisols, and organosols. In the latter two instances, Carbium reportedly demonstrates both low initial viscosity and low viscosity build-up.

Expands line of nylon screws

Close-tolerance screws of molded nylon, manufactured by Gries Reproducer Corp., New Rochelle, N. Y., are now available in new thread sizes, head types, and lengths.

These fasteners are said to offer many design advantages because of the properties of molded nylon: excellent electrical insulation, corrosion resistance, stability over a wide range of temperatures, high strength-to-weight ratio (higher than steel), non-magnetism, and low coefficient of friction.

All molded screws are supplied in natural (off-white); other colors are furnished on special order. Future plans call for expanding the firm's line to include miniature nylon.

Cary in Canada

Formation of Carlew Chemicals, Ltd., St. Remi, Que., for the manufacture of virgin PVC compounds has been jointly announced by Cary Chemicals, Inc., New Brunswick, N. J., and Lewis Specialties, Ltd., Montreal, Que. Lewis Specialties previously acted as Cary's agent for the sale of PVC resins and other materials and will continue in this capacity and also as Carlew's agent for its Polycor PVC compounds.

W. B. Jonah, president of Lewis Specialties, named president and treasurer; G. F. Blasius and K. B. Cary, respective president and chairman of the board of Cary Chemicals, are vice presidents.

Film sales combined

Two leading German manufacturers, Kalle & Co. A. G., Wiesbaden-Biebrich, and Anorgana G.m.b.H., Munich, have combined their plastics film sales, and Kalle will now service customer requirements for both companies. In the United States, this pertains mainly to supplying unplasticized PVC films.

David S. Greenfield, 3143 Decatur Ave., New York 67, N. Y., will represent the Kalle interests and will supervise development of film applications in the flexible packaging, deep-drawn packaging, laminating, and similar fields.

Kalle and Anorgana are subsidiaries of Farbwerke Hoechst A. G., Frankfurt am Main-Hoechst, West Germany, represented in the United States by Progressive Color & Chemical Co., Inc., 350 Fifth Ave., New York 1, N. Y.

Fluorocarbons

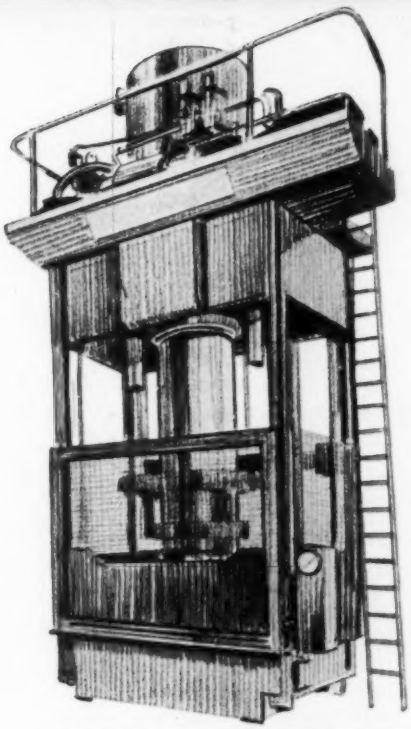
Pressure-sensitive tape. Permacel 422, a pressure-sensitive Teflon tape, claimed to be capable of withstanding continuous operating temperatures of 500° F. and Class H temperature ranges, has been introduced by Permacel-LePage's, Inc. (a Johnson & Johnson company), New Brunswick, N. J. The tape has a 2-mil Teflon film sintered backing with a thermosetting silicone adhesive, and is available in widths from ¼ to 5 in., in rolls 36 yd. long.

Rod diameters increased. Tri-Point Plastics, Inc., Albertson, N. Y., has boosted production of its special TSI type Teflon rod by 25% and extended the range of diameters available. Extruded rod 10 to 12 ft. long, with diameter tolerances of 0.001 in., is now produced in almost 50 diameters ranging from 0.125 to 1.25 inches. Previously, the company produced 40 diameters from 0.125 to 1 inch.

TSI rod is used in the electronics and guided missiles field.

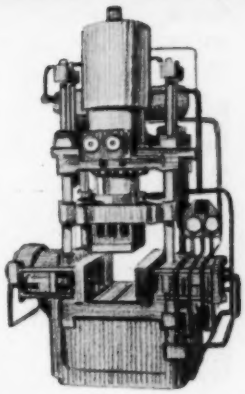
Pressure-sensitive tape. Thermal-curing pressure-sensitive Teflon tape, 0.002 in. thick over-all, has been announced by The Connecticut Hard Rubber Co., 407 East St., New Haven 9, Conn. Called Temp-R-Tape C, the product is designed primarily for electrical insulation, particularly where a high dielectric, extremely thin, easy-to-apply insulation is desirable, such as in miniature electronic components. Anticipated applications include

PLANT FOR PLASTICS?



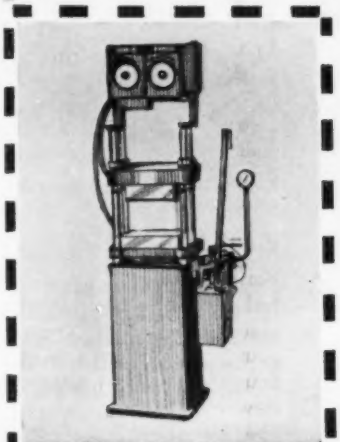
250-ton low-pressure press for reinforced plastics. Fitted Vickers pumping unit and 8 ft. x 5 ft. water-cooled tables.

Platens for steam and electric heating. Hydraulically tested to 500 lb/sq. in.

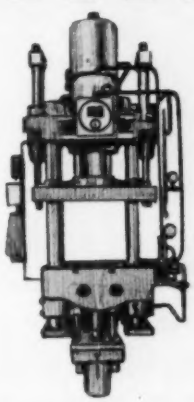


100/60-ton side-ram press. Platen sizes: top, 12 in. x 20 in.; bottom, 21 in. x 20 in.

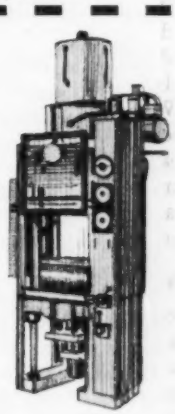
30/30 RPD vacuum forming machine, for straight or drape methods, with or without pre-stretching. Max sheet: 30 sq in.



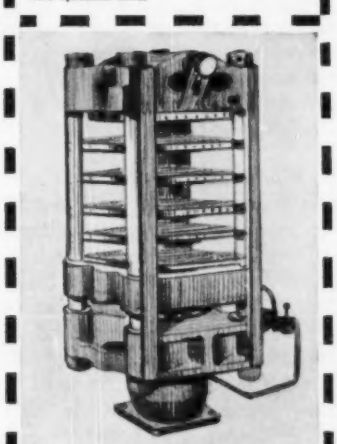
12-ton upstroke press, with electric platens, thermostats and handpump. Works up to 19 tons.



250-ton transfer press, fitted with automatic timing, delay valve, prefiller valve and ejection unit.



50/75-ton transfer press, fitted with automatic timing. 8 in. diam. main ram has 16 in. stroke.



150-ton single-acting upstroke, multi-daylight press, with steam-heated platens.

T. H. & J. DANIELS LTD.

T. H. & J. DANIELS
LIMITED

Lightpill Iron Works, Stroud, Glos., England

Cables: Telex 43-320 Daniels Stroud England

The Plastiscope

slot lining, interlayer and interphase insulation, harness bundling for Class H and higher temperature requirements, etc.; it can also be used in mechanical applications such as low friction facing on tape and film guides.

The tape is said to provide 2750 v./mil dielectric strength and to have an operating temperature range from −100 to 500° F. It is made of specially produced 0.0015-in. cast Teflon film as a backing to which 0.0005 in. of thermal curing pressure-sensitive silicone polymer adhesive is added. Once cured, the tape is said to bond to any clean surface, including its own backing, and not to creep under vibration.

Peel strength at room temperature is said to be 20 oz./in. of width when pressure-sensitive and greater than the breaking strength of the Teflon backing when once cured. Its elongation is reported as 475 percent.

Temp-R-Tape C is available in 18-yd. rolls (3-in. core), ¼, ½, ¾, and 1 in. wide.

Wider tape. Teflon tape in widths up to 24 in. and in thicknesses ranging from 0.005 to 0.096 in. is now being produced by The United States Gasket Co., Plastics Div. of The Garlock Packing Co., Camden, N. J. In addition to its many industrial uses, the tape is currently finding application for ski liners on planes in frigid regions. Cementable tape is also available from the company.

New film material. NF-X, a new film material which will endure extreme temperatures without stiffening or softening and which is intended for use in fuel bladders, tank liners, and pressure equalizers has been announced by Joclin Mfg. Co., Wallingford, Conn. The material is reported to have great resistance to high temperatures of jet engine environments and sub-zero temperatures of high altitude flying. The recommended temperature is from −100 to 400° F. On intermittent thrusts, NF-X bladders are claimed to withstand 600° F.

Bladders are made to order in any size and shape—spherical, eliptical, S-curve—and are entirely without seams.

A method has also been developed to expel liquid propellants from the containers by gas injection.

Thin-wall tubing. Sanstress film, manufactured from virgin Kel-F, has been introduced by Sanford Plastics Corp., Matawan, N. J., for the packaging of sutures. The film is said to withstand sterilization by all conventional methods without distortion. It is also under test for packaging one-shot doses of parenteral solutions, antibiotics, and cosmetic preparations.

Other current uses are in the electrical and allied fields as a non-conducting wrapper for high-temperature wires and for thermal connections.

Reinforced Teflon parts. Facilities for the design, compounding, and molding of reinforced Teflon parts are now in operation at the elastomers plant of Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago 22, Ill. The company blends its own Teflon compounds, permitting formulations to be developed to specification.

Plastic-metal dry bearings. A Teflon trifluoroethylene-lead impregnated bronze structure comprising two completely interlocked sponge-like networks as a dry bearing material, developed by Glacier Metal Co., Ltd., England, is now available from United States Gasket Co., Plastics Div. of The Garlock Packing Co., Camden, N. J., under an exclusive patent licensing arrangement with the British company.

Designated DU, the material is composed of a steel backing on which is sintered a thin lining of spherical bronze, impregnated with a mixture of Teflon TFE and 20% lead, a thin layer of which also covers the bearing surface. The result is a material said to be of very low friction with no slip-stick characteristics, and with wear resistance up to 100 times greater than that of other types of dry bearings; high thermal conductivity and low thermal expansion; high compressive strength (up to 23 tons/sq. in.); and an operating temperature range from −328 to +536° F.

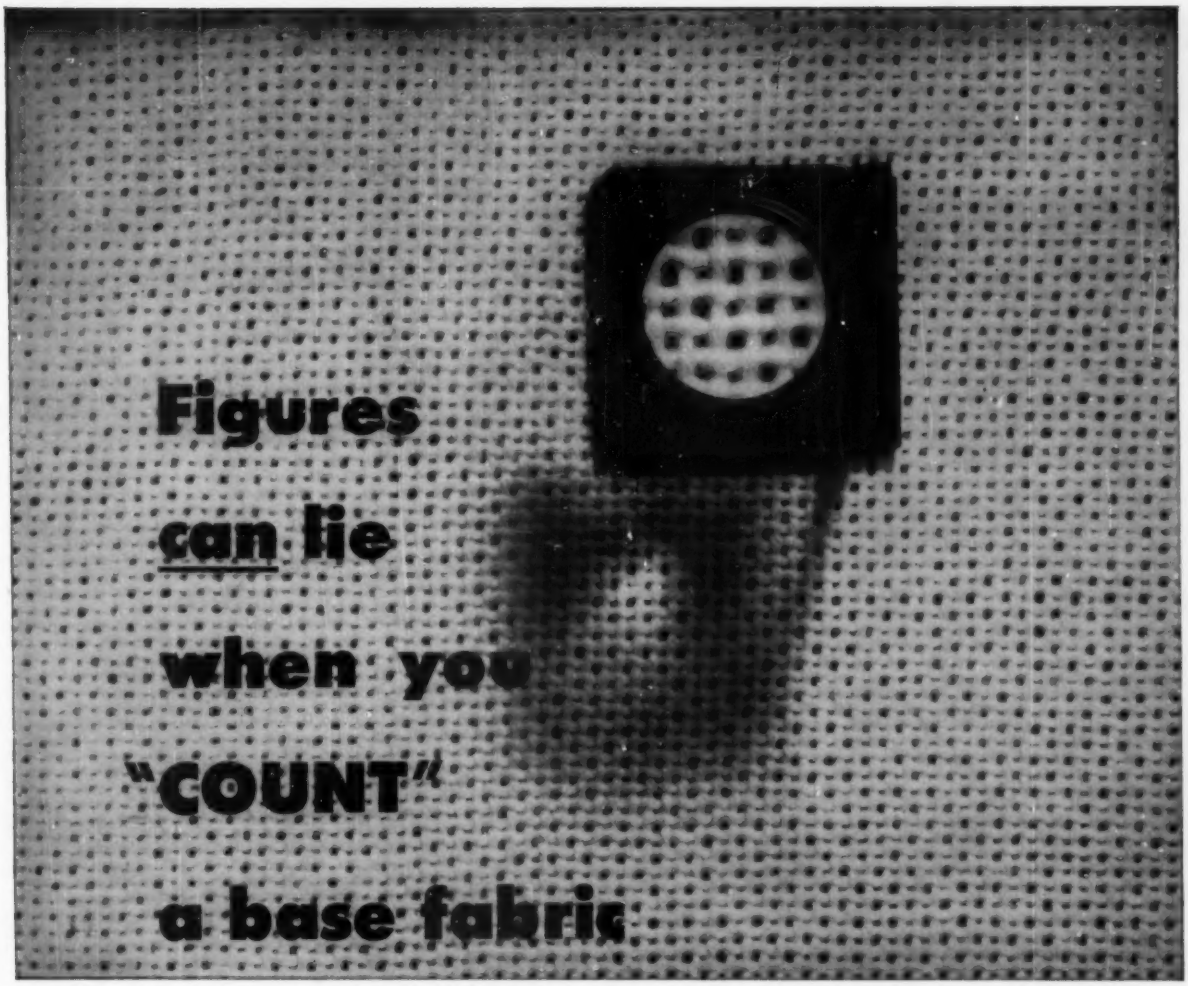
DU is reported to be widely used in the automotive, appliance, industrial machinery, and aircraft industries in England. It is available in strip form in a range of thicknesses from which bushings can be wrapped, thrust washers cut, or hemispherical bearings pressed. A stock of bushings for test evaluation is also available.

Expansion

Air Reduction Chemical Co., Div. of Air Reduction Co., Inc., has announced plans for the construction of a new laboratory and office building at Piscataway Township, N. J. The new laboratory, which is planned as an auxiliary to the company's existing pilot plant development laboratories at nearby Bound Brook, N. J., will provide facilities for increased technical services and application in the field of chemicals derived principally from acetylene.

Cyanamid of Canada, Ltd., a wholly-owned subsidiary of **American Cyanamid Co.,** Montreal, Que., is negotiating for the acquisition of the Canadian business and assets of the **Panelyte Div., St. Regis Paper Co. (Canada), Ltd.,** a subsidiary of St. Regis. Terms, subject to approval by the board of directors of both Canadian companies, have not been finally determined but will cover the transfer to Cyanamid of Canada of the St. Regis plant at St. Jean, Que., which will be used to produce Cyanamid's Formica laminated plastic.

Flambeau Plastics Corp. announces the opening of its new 32,000-sq. ft. office and manufacturing building at 800 Lynn Ave.,



Yarns-per-inch "count" of grey fabric can be completely misleading because of changes produced by finishing and subsequent processing!

"Count" tells how open or tight a woven fabric is. The number of yarns per inch of cloth affects absorbency, adhesion, permeability, strength, bulk, flexibility and other characteristics related to fabric-reinforced plastic or rubber products. But if count is taken in the "grey," dimensional changes caused by pre-shrinking, heat-setting, calendering, napping, singeing, pre-dipping or other processes will not have been considered—and end-product performance may suffer.

Of course, thread count is but one of many factors affecting fabric performance. When your base fabric is one of the wide variety provided by Wellington Sears for coating, laminating, combining and rubberizing, you know that everything has been considered in the light of *your specific need*. And moreover you know that a century of experience is working for you, to anticipate and help solve your basic fabric problems. For free booklet, "Fabrics Plus," write Dept. K-8, Wellington Sears Co., 111 W. 40th St., New York 18, N. Y.

Wellington Sears ***FIRST IN Fabrics For Industry***

For Coated Materials, High and Low Pressure Laminates, and Other Reinforced Plastic Products

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The Plastiscope

Baraboo, Wis. The one-story structure contains a water recirculating system designed to reduce the amount of water used in cooling operations and at the same time provide some of the heating for the building. Electrical heating is hooked up with the water recirculating system but will cut in only when the heat supplied by the chiller units is insufficient. Electric power is supplied by a 240-416 v. system, which provides greater flexibility in the positioning of machinery.

Flambeau was incorporated in 1947 in Bruce, Wis., and moved to Baraboo in 1950. The company now operates two divisions: The **Industrial Div.** molds plastics parts on a custom basis and the **Flambo-Ware Div.** molds items for the housewares, premium, and advertising specialty fields. Flambeau employs about 120 persons and for several years has been operating continually on a six-day week, 24 hr./day schedule. Sales in 1957 were close to $1,750,000 and the firm expects to top $2 million in the near future.

Shell Chemical Corp. has awarded contracts for the construction of the remaining facilities in the glycerine production program at its Norco, La., plant. Cost of this phase of the program was estimated at more than $10 million. Construction is scheduled for completion next year.

One unit will produce acrolein; a second unit will make glycerine, using acrolein and hydrogen peroxide from a unit that the company completed earlier this year. Acrolein-based materials show promise in such fields as plastics and resins, pharmaceuticals, and textile treating, according to **R. C. McCurdy,** president of the company.

The Norco plant will make about 35 million lb. of glycerine a year, plus substantial quantities of acrolein, a chemical not made in large volume until the development of the present process. The company is already selling hydrogen peroxide from the other unit in the glycerine production chain.

Ferro Corp., Cleveland, Ohio, is launching a $500,000 expansion program to provide increased facilities for its Brazilian subsidiary, **Ferro Enamel S.A.,** Sao Paulo, Brazil, and the **Ferro Fiber Glass Div.** in Nashville, Tenn.

The **Andrew M. Martin** interests have acquired **Copolymer Corp.,** 2250 E. 111th St., Los Angeles 59, Calif. Copolymer specializes in compression molding of glass-reinforced polyester shapes for industry, and recently established a division for filament winding of fibrous glass parts.

A. M. Martin is president; **Frederick W. Wade,** vice president; and **Richard Dallas,** assistant general manager. **John Wycoff** will continue with Copolymer in association with the new ownership.

Celebrity, Inc., maker of cosmetic cases and plastics fitted travel kits, has combined all its manufacturing operations and executive offices under one roof at 2590 Park Ave., New York, N. Y. The firm's new structure covers about two-thirds of a block.

Haveg Industries, Inc. has opened a new PVC fabrication shop in its W. Warren, Mass., plant to handle increased work in special chemical process equipment emanating from the New England area. A similar shop has been in operation for three years at Haveg's Marshallton, Del., plant.

Union Carbide Chemicals Co., Div. of Union Carbide Corp., is nearing the half-way mark in the construction of its Technical Center at South Charleston, W. Va. When completed, a campus-like complex of buildings and laboratories will house the company's research, development, engineering, and design and construction departments.

The Technical Center will include development laboratories, a high pressure laboratory, an engineering building, and several auxiliary buildings. In the four-story engineering building, movable panel walls will allow flexibility in size and number of offices on each floor.

The Engineering Dept. of **Union Carbide Olefins Co.** will share the building. This company was formed last year to handle the production and sale of ethylene, propylene, butadiene, and other hydrocarbon products.

Molded Fiber Glass Body Co., Ashtabula, Ohio, has purchased from **Inland Container Foundation, Inc.** the 60,900-sq. ft. plant at 3714 Ann Ave., Ashtabula, formerly occupied by **Inland Container Corp.** The new buildings will house assembly operations, a model and tool shop, and sales and engineering departments.

According to **Robert S. Morrison,** president, Molded Fiber Glass has received orders from a major truck manufacturer for a complete truck cab, and has other new orders for assemblies which will be completed in the new plant.

The company states that sales in 1957 were 51.2% ahead of 1956, and sales for 1958 are running 30% ahead of 1957.

This is the third major expansion since Molded Fiber Glass was formed in 1953. In May 1957, the company acquired a 60,000-sq. ft. plant, also from Inland, and started production in September.

Pantasote Corp. has installed a new vinyl processing line in its plastics products plant at Passaic, N. J. The production line, consisting of an embosser, cooling train, slitter, and continuous winder, was manufactured for Pantasote by **Black-Clawson Co., Dilts Div.,** Fulton, N. Y.

The equipment is designed to handle a 54-in. wide web of vinyl coming directly from a calender.

Columbian Carbon Co. is building research headquarters on Plainsboro Rd., near Princeton, N. J. The facilities, estimated to cost

$1 million, will cover present and expected needs in all phases of research and development on carbon black, pigments, and related fields. The structure is expected to be completed by the end of the year.

Pittsburgh Plate Glass Co. has put into operation new production facilities for dimer polyester resins for urethane foams at the **Ditzler Color Div.,** Detroit, Mich. The new operation augments the established facilities of the Plastics Dept. at Springdale, Pa., Milwaukee, Wis., and Torrance, Calif.

Thunderbird Plastics, Inc., Minneapolis, Minn., has purchased the injection molding and custom extruding departments of **Chippewa Molding, Inc.,** Chippewa Falls, Wis. The company now has nine injection molding machines, one extruder, and a large twin-bed vacuum forming machine capable of handling sheets measuring up to 48 by 72 inches.

Robert D. Kauffman, previously general manager of Chippewa, is now general manager of Thunderbird. He has been in the plastics field since 1929 and was one of the early developers of polyethylene.

Deceased

Philip Kaye, vice president of **Kaye Plastics Corp.,** New Brunswick, N. J., died on June 6 following a short illness.

Meetings

Plastics groups

September 12: Society of Plastics Engineers, Inc., Regional Technical Conference, St. Clair Inn, St. Clair, Mich. Subject: "Plastics in Automotive Application."

October 1: Society of Plastics Engineers, Inc., Regional Conference, Hotel Statler, Hartford, Conn. Subject: "Plastics in Packaging."

October 9-10: The Society of the Plastics Industry, Inc., 14th New England Section Conference, Wentworth-by-the-Sea, Portsmouth, N. H.

October 21: Society of Plastics Engineers, Inc., Regional Technical Conference, Curtis Hotel, Minneapolis, Minn. Subject: "Epoxies."

November 13: Society of Plastics Engineers, Inc., Regional Technical Conference, Ambassador Hotel, Los Angeles, Calif. Subject: "Plastics in Building and Construction."

November 17-21: The Society of the Plastics, Industry, Inc., 8th National Plastics Exposition, International Amphitheatre, Chicago, Ill.

November 17-21: The Society of the Plastics Industry, Inc., S.P.I. Annual National Conference, Morrison Hotel, Chicago, Ill.

Other meetings

September 9-12: National Chemical Exposition, in conjunction with the 134th National Meeting of the American Chemical Society, International Amphitheatre, Chicago, Ill.

October 8-10: Industrial Designers Institute, Design Materials Show and Annual Conference, Sheraton-East (formerly Hotel Ambassador), New York, N. Y.

October 20-22: Technical Association of the Pulp and Paper Industry, 13th TAPPI Plastics-Paper Conference, Sheraton-Kimball Hotel, Springfield, Mass.

October 20-24: American Vacuum Society, Inc., 5th National Vacuum Symposium, Sir Francis Drake Hotel, San Francisco, Calif.

October 28: Association of Consulting Chemists and Chemical Engineers, Inc., 30th Annual Meeting, Biltmore Hotel, New York, N. Y.

November 4-6: Packaging Association of Canada, Canadian National Packaging Exposition, Automotive Building, Exhibition Grounds, Toronto, Ont.

November 5-6: Society of Vacuum Coaters, Annual Meeting, Hotel Statler, Detroit, Mich.

Companies . . . People

The Society of the Plastics Industry, Inc., Reinforced Plastics Div.: The Fiberglass Reinforced Panel Council elected **George R. Huisman** chrmn. and **Leonard S. Meyer** vice-chrmn. for the year 1958-1959. Mr. Huisman, VP—manufacturing, **Filon Plastics Corp.**, succeeds **John S. Berkson**, pres. of **The Alsynite Corp. of America.** Mr. Meyer is affiliated with **International Molded Plastics, Inc.**

The Council is comprised of panel manufacturers and suppliers of raw materials which accounted for a major portion of the 50 million sq. ft. produced in 1957.

In order to expand and intensify its program during the coming year, the Council has set up three main sub-committees—a Technical Committee, Code Committee, and Advertising and Promotion Committee. Additional funds were voted for the Code Advisory Committee which will permit it to increase its activity in the building field.

United States Rubber Co.: Three asst. dirs. of research and development appointed to streamline the firm's activities and expedite new developments from the laboratory to the production plant: **Dr. Arthur E. Brooks** will direct all research on materials; **T. J. Rhodes** will head up all engineering research; and **Dr. D. Lorin Schoene** will direct liaison between the research and development department and the manufacturing divisions.

Monsanto Chemical Co.—Plastics Div.: James C. Berry has joined the Production Dept. and **Robert A. Boucher** the Staff Services Dept. **Robert W. Miller** is now a member of the Research Dept.

Organic Chemicals Div.: Herbert S. Parham now a dir. of sales. **Armin L. Klemm** appointed dist. sales mgr. at Los Angeles, Calif.

Overseas Div.: William M. Russell named asst. gen. sales mgr. He was formerly a dir. of sales of the Organic Chemicals Div.

Taylor Fibre Co.: Dr. Peter L. Shanta, appointed tech. dir., will be in charge of all research, product development, and quality control activities of the company. He succeeds **Dr. C. N. Jacobs,** VP and dir., who will retire at the end of the year. **Gordon H. Platt** named sales engineer, with headquarters at W. Hartford, Conn. He will be responsible for application sales of Taylor vulcanized fibre and laminated plastics products in Connecticut, Vermont, and western Massachusetts.

Reynolds Metals Co.: A plastics sales division was established at company headquarters in Richmond, Va., with **W. J. Vogel** as gen. mgr. He was previously manager of the plastics plant at Grottoes, Va., and also directed sales operations from there. **Richard M. Chamberlin,** formerly asst. mgr., succeeds Mr. Vogel as plant mgr.

The Grottoes plant makes various formulations of polyvinyl chloride and water-soluble polyvinyl alcohol films.

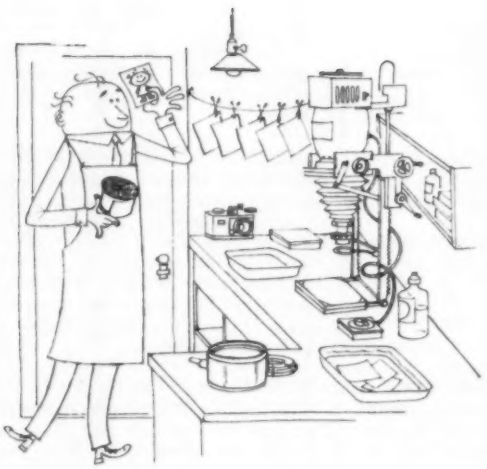
American Molding Powder & Chemical Corp.: Howard A. Johnson, previously with Interchemical Corp., appointed product and plant mgr. **Myles Schneider,** named dir. of tech. sales service, was formerly engaged in development work in the Kralastic section of Naugatuck Chemical Div., U. S. Rubber Co. **Morty Winter** appointed sales rep.

W. R. Grace & Co., Dewey & Almy Chemical Co. Div.: James F. Murphy, Jr. appointed project mgr. of the new $4 million Owensboro, Ky., plant;

From the Dow family of plastics . . . look to

STYRON

and its variety of highly moldable formulations



This photo developing tank would be a nightmare for the molder if it weren't for versatile Styron*.

Four different Styron formulations were employed, all of which have two things in common: exceptional moldability and unyielding resistance to chemicals commonly used in photographic processes. The tank wall and cover are Styron 700 in a special opaque camera black, selected for its high gloss finish and heat resistance. Styron 475 was used for the integrally molded center shaft and lower reel because of its excellent strength and ease of fabrication.

The crystal clarity and easy moldability of Styron 666 were put to good use in the upper reel. For one of the most difficult molding assignments—the thermometer-agitator rod—Styron 689 with its exceptional flow characteristics for intricate molds was chosen.

You get advantages like these with each member of the Dow family of thermoplastics. See your Dow man soon. THE DOW CHEMICAL COMPANY, Midland, Michigan, Plastics Sales Department 1534A-1.

*Trademark of The Dow Chemical Company

From developing tanks to pipe linings—

Dow plastics lead the way

DOW

STYRON* • TYRIL* • ETHOCEL* • SARAN • POLYETHYLENE • PVC RESINS

Companies . . . People

Craig Falk named head of the organic chemicals area and **Richard R. Shallberg** will be in charge of the battery separator area.

The Owensboro facility doubles the company's production capacity for vinyl acetate polymers and copolymers and styrene-butadiene copolymer latices, and will substantially increase facilities for resin-impregnated battery separators used between the plates of automotive storage batteries.

Allied Chemical Corp.—Barrett Div.: Two separate divisions will be created to manufacture and market the product lines now handled by Barrett. Roofing, building, and paving materials will be separated from plastics and coal chemicals and sold under the Barrett Div. name. The manufacture and sale of plastics, resins, and industrial chemicals will be conducted by the Plastics and

T. Kinsella

H. Cyphers

Coal Chemicals Div. **T. J. Kinsella**, head of Barrett since 1952, will be pres. of that division. **Harry W. Cyphers, Jr.**, appointed product supv., will coordinate divisional activities pertaining to research, manufacturing, technical service, and sales of Plaskon alkyd molding compounds.

Solvay Process Div.: Herbert S. Kishbaugh named asst. mgr. of the New York sales branch, with headquarters at 261 Madison Ave. **Peter J. Cambourelis** appointed. tech. asst. to the dir. of product development.

Nitrogen Div.: Jacob White, formerly a VP, appointed pres. of the division.

Shell Development Co.: Robert W. Martin, formerly acting asst. department head of the Plastics and Resins Dept. at the Emeryville, Calif., Research Center, was given a two-year appointment as tech. asst. to **Dr. Harold Gershinowitz**, pres., in New York City. He replaces **Curtis W. Smith**, who has returned to Emeryville to resume as asst. department head of the Plastics and Resins Dept.

The General Tire & Rubber Co.: The Plastics Div. has integrated its four separate style and design divisions. **Robert H. Hurley** named to the newly-created post of mgr. of central styling and design. Central styling will be responsible for the design of all vinyl products made by the **Bolta, Textileather, Jeannette,** and

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Respro Divs. Offices and design studios will be located at the Bolta plant in Lawrence, Mass. **Wallis E. Stuart III,** formerly designer for the Jeannette Div., now chief designer for the new organization.

William J. McCaig, previously sales mgr. of Polyfoam, General's urethane foam cushioning material, appointed gen. sales mgr. for all products manufactured at the company's Marion, Ind., plant. He is succeeded by **Jack E. Beach.**

Irv Schildkraut appointed sales rep. in metropolitan New York for **Milprint, Inc.,** Milwaukee, Wis., manufacturer of flexible packaging.

Industrial Molding Corp., 8924 Lindblade St., Culver City, Calif.: **Robert I. Bloom** named pres. and **Bernard Diggins** VP of this newly formed custom injection molding company.

A. Schulman, Inc., Akron, Ohio: **William C. Zekan** named exec. VP and **Dudley G. Brattin** treas. and comptroller.

Trubor Mfg. Co., Inc., 50 Suffolk St., Worcester 4, Mass., has been recently formed and will offer a repairing and replacement parts service to users of injection molding machines. The services available include repairing heating cylinders and electrical wiring, rebuilding toggle clamping units, reboring scored straight-bore heating cylinders, installing hardened liners, replacing hydraulic pumps and valves, and repairing timer clocks.

George J. Degon is president and treasurer, and **Frederick W. McIntyre, Jr.** a director. Both were formerly associated with Reed-Prentice Corp.

McIntyre Machine Sales Co., 112 Beeching St., Worcester 2, Mass., recently organized, will handle the sales of injection molding machinery, together with allied accessories and supplies, in the New England states.

Officers of the company are: **Albert R. McIntyre,** pres.; **Frederick W. McIntyre, Jr.,** treas.; and **Frederick W. McIntyre, Sr.,** secy. The McIntyre group was affiliated with Reed-Prentice Corp. for many years.

Arvin Industries, Inc., Columbus, Ind., has consolidated its Electronics and Appliance Div. and Furniture and Housewares Div. into a single **Consumer Products Div. John C. Marshall,** VP and former gen. mgr. of the Electronics & Appliances Div., will head the new division. **Orphie R. Bridges,** VP and former gen. mgr. of the Furniture & Housewares Div., will be in charge of product development.

Consumer products in the past have accounted for about half of Arvin's business. The Automotive Div., which manufactures mufflers and other parts, vinyl-metal laminates, and plastics gages tools, has accounted for the balance of the company's business.

Food Machinery & Chemical Corp. —Chemical Divs.: Dr. Hans O. Kauffmann and **Dr. Oscar H. Johnson** named dirs. of research and development for the Inorganic Chemicals Dept. and Organic Chemicals Dept., respectively. Dr. Johnson will direct the basic organic research programs for the newly formed Organic Chemicals Dept., comprising Niagara Chemical Div. and the Chemicals and Plastics Div., at the FMC Central Research Laboratory.

Becco Chemical Div.: John R. Hopkins, with the company 23 years and previously tech. asst. to the sales mgr. at Buffalo, N. Y., now asst. sales mgr. He will be in charge of the division's advertising and publicity departments, as well as assisting **Albert P. Shutts,** sales mgr., in the supervision of all field sales activities for the company.

Rainville Co., Inc., Garden City, N. Y., named exclusive sales rep. for the line of plastics injection molding machines manufactured by **Crown Machine & Tool Co., Inc.,** Fort Worth, Texas. Crown machines operate automatically and mold thin

walls, at a fast rate. Another feature of the firm's Moldmaster machine is twin injection with fast ram speeds, thus greatly increasing production without expensive multi-cavity molds.

Haveg Industries, Inc.: John W. Carrow III, sales mgr. since 1956, elected a VP. He is succeeded by **John B. Mackenzie,** formerly asst. sales mgr.

Rogers Corp., Rogers, Conn., has licensed its method of producing RX medium and medium-high-impact phenolic molding materials to **Vynckier Freres et Cie.,** Ghent, Belgium, one of Europe's largest producers of molded parts for the electrical industry.

Zack Radiant Heat Co. (formerly **Zack Industries**) has moved from 185 Goffle Rd., Hawthorne, N. J., to 23-A Vreeland St., Lodi, N. J. The firm manufactures radiant heaters and vacuum forming machines.

National Lead Co., Titanium Pigment Corp.: Allan G. Davies named New York dist. sales mgr. **Henry E. Melvin** transferred from Los Angeles to San Francisco, Calif., as sr. salesman in charge of the sales office.

Diamond Alkali Co.: C. C. Brumbaugh, formerly dir. of engineering, named VP concerned with engineering, research, and technical aspects; **Robert C. Sutter,** previously operations mgr. of the Chlorinated Products Div., succeeds Mr. Brumbaugh as dir. of engineering.

Wagner Plastic Corp. has moved from 6500 Hudson Blvd., West New York, N. J., to a new and larger plant located on Route 88, Lakewood, N. J. The firm is engaged in custom molding.

Sprague-Martin Vacuum Plating Co., Inc. has moved into its new plant at 333 Broadway, Bayonne, N. J. The company claims to be the first to successfully vacuum metallize polyethylene.

Herman R. Thies, gen. mgr. of **The Goodyear Tire & Rubber Co.'s Chemical Div.,** has received an honorary doctor of science degree from his alma mater, Phillips University, Enid, Okla.

Mr. Thies joined Goodyear in 1930 as a rubber research compounder and in 1936 became asst. dir. of research; in 1943, he was appointed mgr. of Pliolite sales and two years later became head of the Plastics and Coatings Div. When the Chemical Div. was organized in 1948, Mr. Thies was named mgr., and in January 1954, he became gen. mgr.

Ralph S. Binns appointed VP of **Carlisle Chemical Works, Inc.,** Reading, Ohio. In February 1957, Mr. Binns was named gen. mgr. of **Advance Solvents & Chemical Div.** of Carlisle; he will continue in that position, making his headquarters at the Advance plant in New Brunswick, N. J.

Dr. Frank G. Pearce named dir. of project engineering for **Amoco Chemicals Corp.,** Chicago, Ill. He will supervise engineering development of new projects, including raw material availability and process economics, and will be responsible for technical soundness of projects before construction.

William T. Ylvisaker appointed gen. mgr. of **Parker-Kalon Div., General American Transportation Corp.,** Clifton, N. J., manufacturer of fasteners, to succeed **Eli Ogulnick,** resigned.

Francis V. Duffy, formerly dir. of sales research in the Chemical Div., appointed sales mgr. for nylon products for **Foster Grant Co., Inc.,** Leominster, Mass.

Foster Grant recently made the transition from pilot plant to full-scale production at its new nylon-6 plant in Manchester, N. H., to become the fourth nylon producer in the country.

Fred G. Adams named to the newly-created post of marketing dir. of **Chicago Molded Products Corp.,** Chi-

Companies... People

cago, Ill. He will serve as staff asst. to the pres. and gen. mgr. on all matters concerning marketing, which will include the coordination of all activities of the Advertising, Sales Promotion, and Market Research Departments.

Dr. Robert J. Nebesar, named gen. mfg. mgr. of **Zenith Plastics Co.,** Gardena, Calif., will be responsible for operations of the firm's Technical and Manufacturing Departments.

A. L. Back has opened a consulting service under the name of **A. L. Back & Associates,** West Chester, Pa., and will specialize in polymer, latex, rubber, and engineering problems. Mr. Back is currently teaching evening courses in rubber technology at Villanova University and Temple University.

Eugene J. Sullivan, who started as a glue salesman at **Borden Chemical Co.** 12 years ago, appointed exec. VP of the company. In charge of sales since January 1957, he succeeds **H. H. Clarke, Jr.,** who resigned to become pres. of **Dyna-Therm Chemical Corp.,** Culver City, Calif.

Daniel B. Witwer, formerly mgr. of the Acetylene Chemicals Dept. of General Aniline & Film Corp., elected VP of **Polyvinyl Chemicals, Inc.,** Peabody, Mass., manufacturer of acrylic, vinyl acetate, and styrene polymer emulsions.

Walter J. Merck, formerly eastern regional sales mgr., Chemical Products Group, Minnesota Mining & Mfg. Co., appointed VP and national sales mgr. of **Hitemp Wires, Inc.,** Westbury, N. Y.

Dr. R. E. Hughes appointed mgr. of development of **Canadian Resins & Chemicals, Ltd.,** Montreal, Que.

Donald R. Butler appointed mgr. of the newly created Thermoplastic Sheet Forming Div. of **Plastic Products Corp.,** Cleveland, Ohio. The division will conduct custom and proprietary molding and its production will be closely coordinated with the firm's fibrous glass molding operations.

Milton C. Taft named design engineer — optical materials, **Rowland Products, Inc.,** Kensington, Conn., manufacturer of cellulose plastics sheet.

Alfred P. Ulrop named tech. service rep. for **Sylvan Plastics, Inc.,** wholly-owned subsidiary of **American Viscose Corp.** With headquarters at Fredericksburg, Va., he will handle customer service and analysis and evaluation of molding compounds. Mr. Ulrop was formerly associated with Rochester Button Co., Button Corp. of America, and Great Lakes Button Co., and was one of the founders of Ulrop Plastics, Inc.

Wyman L. Taylor, previously adm. asst. to the VP on the Pacific Coast, now western sales mgr., Industrial Chemicals Div., **Stauffer Chemical Co.,** with headquarters in San Francisco, Calif.

John M. MacDonald promoted from sales engineer to mgr. of market development of **Appleton Machine Co.,** Appleton, Wis.

Walter J. Beasten, previously New York dist. sales mgr. for **Du Pont's Pigments Dept.,** appointed an asst. sales dir. of the department. **H. Kenneth Carter,** formerly salesman in the New York office, succeeds Mr. Beasten.

Robert E. Dowds, formerly prod. mgr., now staff asst. to the VP of manufacturing operations of **Milprint, Inc.,** Milwaukee, Wis.

Jack Sherman has resigned as pres. of **Plicose Mfg. Corp.,** Brooklyn, N. Y. He was one of the founders of the company and is a pioneer in the polyethylene film industry.

The Pantasote Co.: Fred C. Strype, Inc., 20 Vesey St., New York N. Y., and **The Blue Ridge Fruit Exchange,** Waynesboro, Pa., appointed distributors for Panta-Pak, the company's new plastics packaging material.

James E. Ochs named eastern sales rep. for **Fabricon Products, a Div. of Eagle-Picher Co.,** River Rouge, Mich., to handle its line of pre-impregnated papers, fabrics, and special carriers.

George Myers has joined **Thiokol Chemical Corp.** as tech. rep. in the polyurethane sales group. The company is producing polyurethane resins as a part of the Chemical Div.'s market diversification program.

James D. Callahan has joined **Hastings Plastics, Inc.,** Santa Monica, Calif., as advertising and sales promotion mgr. He served in the same capacity for Rezolin, Inc. before opening his own office as public relations consultant.

William A. Hart named Chicago tech. and sales rep. of **National Tool & Mfg. Co.,** Kenilworth, N. J., manufacturer of standard mold sets and accessories. Mr. Hart's address is Route 2, Box 278, St. Charles, Ill., and he can be reached by telephone at St. Charles 6473.

Francis C. Thompson has joined **Marbon Chemical Div., Borg-Warner Corp.,** Gary, Ind., as tech. sales rep. for Indiana and western Michigan.

Everett Sklarz named eastern regional resin sales supv. for **Archer-Daniels-Midland Co.,** Minneapolis, Minn.

H. Arthur Tonnesen appointed sales engineer in the New Jersey area for **Comco Plastics, Inc., Div. of Commercial Plastics & Supply Corp.,** Ozone Park, N. Y.

Elmer N. Hokanson, formerly with Du Pont's Arlington Works, has joined **The Mearl Corp.,** 153 Waverly Pl., New York, N. Y., producer of pearl essence and Nacromer, a synthetic pearl essence. He will be responsible for product application and development work.

William A. Swanston, Jr. named sales engineer of the **Special Products Div., Samuel Moore & Co.,** Mantua, Ohio. He will concentrate on the development of plastic extrusions.

Andrew J. Havrilla, Springfield, Mass., named manufacturer's agent for reinforced plastics building panels and flat panes manufactured by the **Structoglas Div., International Molded Plastics, Inc.,** Cleveland, Ohio.

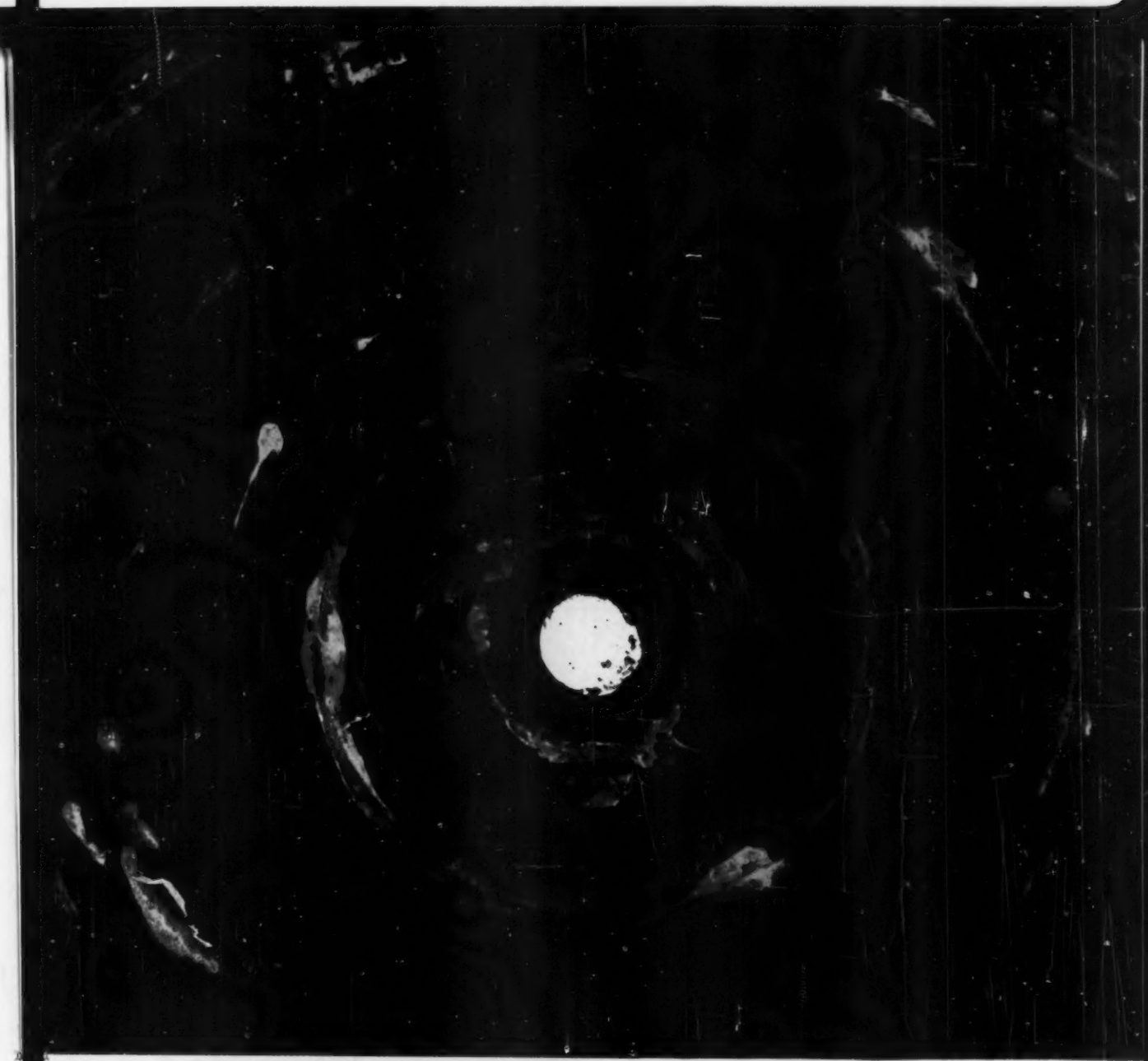
John E. Sweeny, Jr. named rep. for **Synthane Corp.,** Oaks, Pa., with headquarters at the recently established Pittsburgh, Pa. office.

Emil R. Gazdik, formerly sales engineer of Evans Winter Hebb, Inc., now eastern regional engineer of **Automatic Molding Machine Co., Div. of Wagner Brothers, Inc.,** Detroit, Mich.

Corrections

"Now—into the space age!" (MODERN PLASTICS 35, 105, June 1958): The following two companies engaged in the production of high-temperature resistant reinforced plastics for the missile field were inadvertently omitted: Raybestos-Manhattan, Inc., Manheim, Pa., and the Electro-Technical Products Div. of Sun Chemical Corp., Nutley, N. J.

"Beautiful backs" (MODERN PLASTICS 35, 125, June 1958): Correct credits for the Philco television set should read: Back molded from Bakelite's cold polymer polystyrene TMD2155 by American Insulator Corp., New Freedom, Pa.; front molded by Buffalo Molded Plastics, Buffalo, N. Y., from Koppers' P-2121A styrene.



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Machinery and equipment for sale

FOR SALE: 1 MPM 1½" electrically heated plastics extruder; 1 Watson-Stillman 470 ton compression press, 48 x 32" platen; 3 stainless steel ribbon blenders, 33, 7 and 3 cu. ft.; 3 Cumberland granulators, 3 HP; 1—22x60" plastics mill, 150 HP; also choppers, mixers, presses, etc. Chemical & Process Machinery Corp. HY. 9-7200.

FOR SALE: Stokes 300 ton and Baldwin-Southwark 200 ton semi-automatic transfer molding presses. 2500 ton downstroke 54" x 102". French Oil 250 ton 38" x 28". Elmes 200 ton 28" x 26". Farrel 200 ton 20" x 80". 200 ton Hobbing press. 200 ton 16" Record presses. D & B 140 ton 36" x 36". French Oil 120 ton self-contained. W.S. 120 ton 24" x 24". Hydraulic pumps and accumulators. Van Dorn 1 and 2 ounce injection machines. Other sizes to 80 oz. Baker-Perkins and Day jacketed mixers. Plastic cutters. Oxford 57" slitter. Seco 6" x 13" and 8" x 16" Mills and calenders. Oil and elect. plastic extruders, lab to 6". Single & Rotary preform Presses ½" to 4". Partial listing. We buy your surplus machinery. Stein Equipment Co., 107—8th St. Brookyn 15, New York.

LIQUIDATION SALE: Molding plant; (2)—325 ton French Oil Compression presses. (1)—300 ton Erie Compression press. (2)—170 ton transfer presses. (3)—75 ton transfer presses. Press. (3)—75 Ton Transfer Presses. (1)—No. 5½ T Colton Preform machine. (1)—3 DT Colton Tablet machine. Repy Box 3801, Modern Plastics.

FOR SALE: Injection molders: 1 oz. & 2 oz. Van Dorn; 8 oz. Reed-Prentice double link 9 oz. H.P.M. Extruders: MPM 1½" with cross head, elec. htd.; two Hartig 3¼" elect. htd. with reliance drives, one with tubing takeup; NRN 1½" wire coating ine, complete. New extruders, JMC 1½" to 6" sizes, 21:1 ratio, variable speed drives. Hydraulic molding presses: 300 ton Lake Erie, 36" x 36" platen, self contained; Stokes 50, 100, 150, 200, 300 ton presses, bar controls. Transfer presses: Dunning & Boschert 150 ton to 400 ton; Lake Erie 200 ton and 300 ton. Tablet presses: Stokes model R, model T, model 280-G, model DDS-2; Defiance model #45; Colton model 5-T. Scrap cutters: Ball & Jewell Nos. 2, 1½, 1, ½; Robinson 10 hp, MD. 2-roll plastic mills: new JMC 6" x 13" Lab Mill, self contained, 7½ hp drive, 4" bearings. Write for brochure. Johnson Machinery Co. 683-R Frelinghuysen Ave., Newark, New Jersey. BIgelow 8-2500.

FOR SALE: 5-750 gal. Stainless reactors. 12—Baker-Perkins 200 gal. Sigma-blade mixers. Pfaudler glass-lined reactors: 500, 300, 100, 30 gal. Farrel-Birmingham 1500 HP horiz. reducer, 5:1 ratio. Ribbon mixers 336, 200, 75 cu. ft. Stokes tablet or preform presses, rotary cutters, mills, etc. Perry Equipment Corp., 1429 N. 6th St., Phila. 22, Pa.

FOR SALE: (6) 100 ton, 10" ram, 10" stroke @ $1250; (7) 200 ton, 9" stroke, 14" ram, 36x36, @ $2160; (6) 200 ton, 9" stroke, 15" ram, 30x30 @ $1850; (1) ton complete, 18x18 @ $1850; (1) 200 ton 16" ram, 30x30 @ $2460; (2) 200 ton 16" ram, 42x42 @ $2850; (1) 200 ton, 15" ram, 42x42 @ $2600; (3) 250 ton (2) 12" ram, 30x60 rebuilt @ $3675. Hydraulic Sal-Press Co., Inc., 386-90 Warren Street, Bklyn., N.Y.

FOR SALE: 64 oz. Injection Molder with Pre-Plasticizer mold size 32"x50" 750 Ton clamp. Lester 8 oz. Model 2½ L (1949). DeMattia 12 oz. (1946). DeMattia 4 oz. H.P.M. Rubber Injection molders, 21½" x28" mold space, steam heated platens. Watson-Stillman 300 ton Semi-Automatic Compression molding press (1947) self-contained, mold size 34"x27". Watson-Stillman 250 ton 28"x24". Watson-Stillman 140 ton 22"x16". Waterbury Farrel 85 ton 20"x24". W.F. 63 ton 15"x15". Laboratory Presses—15 ton 10"x8" and 10 ton 6"x6" Platens. (2) 8 ounce Reed Prentice injection molding machines and (1) 8 ounce Lester Phoenix (late) with nylon attachment. Scrap Cutters, Valves, Accumulators, Hydraulic Presses—all sizes. Aaron Machinery Co. Inc., 45 Crosby St., New York, N.Y. Tel.: WAlker 5-8300.

FOR SALE: Late models (2) L-2-8 Lester Injection molding machines. Like new, can be seen in operation in New York area. Reply Box 3802, Modern Plastics.

COMPLETE PIPE EQUIPMENT: NRM 2½" extruder and all accessories to make polyethylene pipe up to 2" and butyrate up to 4". Moderately used, very good condition. One owner. Reply Box 3803, Modern Plastics.

FOR SALE: 2-9 ounce HPM and 1-8 ounce Reed injection presses; 1-200 ton HPM compression press. Milwaukee Plastics, Inc., 4044 North 31st Street, Milwaukee, Wisconsin.

FOR SALE: 1 Baker Perkins 15USE, 100 gal. all stainless double arm Vacuum mixer; 1—Baker Perkins size 15VUUM, 100 gal. double arm mixer, 100 HP motor; 1—Baker Perkins size JNM 100 gal. double arm mixer; 6—Day 250 and 100 gal. double arm mixers; 1—Ball & Jewell #1 Rotary Cutter; 2—Two Roll Mills 6" x 12"; 6—Stokes model DD2, DS3, D3 and B2 Rotary Preform presses; 4—Stokes model "R" single punch Preform presses; Also: Sifters, Banbury mixers, Powder mixers, etc., partial listing; write for details; we purchase your surplus equipment; Brill Equipment Co., 2407 Third Ave., New York 51, N. Y.

16-OZ. INJECTION MOLDER: Manufactured by H.P.M. with Wheelco and Garvin controls: in operation until last month: Very low price. Various sized scrap grinders in stock, hydraulic presses, pumps and vacuum impregnator. Abbott Machinery Co., 117-123 Peters St., Union City, N. J. Phone: UNion 5-1700.

GOOD EQUIPMENT: At the right price. Falcon Ribbon Blenders in Steel or Stainless; NRM 2½" Extruder, Rotary Cutters by Ball & Jewell, Sprout-Waldron, Abbe; Baker Perkins heavy duty dbl. arm Mixers, 100, 200, 300 gal; French Oil Mill Hydr. Press 450 Ton; Blaw Knox S/S Resin Kettle 7'6"/7'6", Jktd. Agtd.; Sturtevant 300 cu. ft. Batch Mixer; Stokes and Colton Rotary and Single Pre-form Presses; Send for new First Facts, containing complete illustrated inventory; First Machinery Corp., 209 Tenth St., Bklyn 15, N.Y. Fred R. Firstenberg, Pres.

FOR SALE: Injection molding machines, 3 oz. Fellows, 8 and 12 oz. Lesters, 50 oz. Impco—400 ton 36" x 36" and 1000 ton vertical presses—No. 1½ Ball & Jewell rotary cutter—Carver laboratory presses and others to 75 ton—6" x 13" laboratory mills—miscellaneous hydraulic valves and fittings. Plastic Machinery Exchange, 426 Essex Avenue, Boonton, N. J.—cable address Plasmex-Boonton.

FOR SALE: 2 oz. Van Dorn, lever type, $1650; (3) 2 oz. aut. molding machines w/accumulator; 4 oz. Lewis, 1954, $3500; 4 oz. Acme, 1953, $5000; 4/6 oz. R-P, 1955; 4 oz. vert. DeMattia; 8 oz. R-P, 1948, $6500; 8 oz. R-P, 1946, $6000; 12 oz. W-S Model E, $6500; 12 oz. DeMattia, toggle, $5000; 12/16 oz. DeMattia, Model M, $16,500; 12 oz. Lester w/solid frame, $5500; 16 oz. & 20 oz. vert. Impcos; 20 oz. R-P w/32 oz. cyl., almost new; 32 oz. R-P w/48 oz. cyl. exceptional; 48 oz. W-S, 1950; Model #246 Vactrim vacuum former; Preplasticizer for 16 oz. H.P.M., 48 oz. cap., almost new, for Model 350 B; tumbling barrels, ovens, grinders, etc. Partial listing—other equipment available. Acme Machinery & Mfg. Co., Inc., 2315 Broadway, New York City, SU 7-1705.

JUST SECURED: Most Modern Packaging and processing machinery. Equipment installed within last 2 years. Available at great savings. 4—Hayssen model F compaks with net weight scales, bulk and dribble feeds, electric eyes. 4—Ceco model 40-9½-GG automatic adjustable cartoning units. Also model TT. 1—Pneumatic Scale automatic carton feeder, bottom sealer and top sealer with interconnecting conveyors. 6—Fitzpatrick model D-6 Stainless steel comminuters. 4—Day size G. 1500 lb. Ribbon type powder mixers. 2—Rietz disintegrators model RD18 complete with 50 HP motors. 1—Enterprise Foundry Disintegrators model EVM3 complete with 50 HP motors. Complete details and quotations promptly submitted. Union Standard Equipment Company, 318-322 Lafayette St., New York 12, N. Y., Phone: CAnal 6-5334.

Machinery wanted

WANTED: Used injection molding machine, 2 to 6 oz. capacity; must be low priced and in workable condition. Or what have you? Prefer midwest location. Cash deal. Holmes White Metals Company, Holmes, Iowa.

(Continued on pg. 234)

(Continued from pg. 232)

MACHINERY WANTED: We want to buy a vacuum forming machine, late model. Completely automatic with drape forming. Reply Box 3804, Modern Plastics.

WANTED: Two-ounce laboratory injection molding machine, N.R.K. model 1300, hand-operated or similar. Reply Box 3805, Modern Plastics.

WANTED TO BUY: Used injection molding machines, oven, granulators. One machine or complete plant. Acme Machinery & Mfg. Co. Inc., 20 South Broadway, Yonkers, N. Y. YO 5-0900, 102 Grove Street, Worcester, Mass., Pl 7-7747.

Materials for sale

FOR SALE: Polyethylene and acetate pellets, clear and all colors. Plastic Molding Powders, Inc., 2004 McDonald Ave., Brooklyn 23, N. Y. Esplanade. 5-7943.

DOW HI IMPACT: Large quantities of attractive colors in Dow Hi Impact polystyrene available for immediate shipment. For samples and prices contact Reed Plastics Corporation, 116 Gold Street, Worcester, Massachusetts.

FOR SALE: Virgin styrene—cut costs—save money. High impact: Natural, standard and special colors, pastels. Medium impact: Standard and special colors, pastels. General purpose: Crystal, all standard and special colors. Ask for our low price quotations. We will match your color needs. Erie Plastics Co., P.O. Box 1068, Erie, Pa. Phone 2-2503.

FOR SALE: 30,000 lbs. virgin natural hi impact styrene. 20,000 lbs. virgin pastel shades hi impact styrene. 25,000 lbs. virgin natural polyethylene. Also standard toy colors polyethylene. Low prices. Reply Box 3806, Modern Plastics.

WE HAVE THE FOLLOWING FOR SALE: One—2 roll embossing calender, having Micro-type housings equipped with pneumatic air cylinders for applying pressure; including Foxboro control panel with two-needle instrument. Pressure 14-ton. Top roll—forged steel-machined—ground and polished to mirror surface, chrome plated. 11" diameter x 63" face; bored—2" wall—and equipped with rotary union for steam heat. Bottom roll—rubber—22" diameter x 62" face. Top bearing housings have split cap. Driven brass scroll rolls at the entering end of calender. Drive—7-½ H.P. Reeves Moto drive 46.5/11.6 RPM. and chain drive. Purchased from: H. W. Butterworth & Sons Company—1953—Eagle Ottawa Leather Co., Grand Haven, Michigan.

Materials wanted

WANTED: Polyethylene - acrylic film sweepings - purgings - parts - cast sheet scrap, etc. Also: Other types of plastic scrap. Claude P. Bamburger, Inc., One Mount Vernon Street, Ridgefield Park, N.J. Telephone: HUbbard 9-5330.

PLASTIC SCRAP WANTED: From molders, vacuum formers, fabricators; acrylic, styrene, polyethylene, acetate, butyrate, etc. For top prices write, wire, phone collect. Philip Shuman & Sons, 15-33 Goethe St., Buffalo 6, N. Y. Tel: HUmboldt 1811.

WANTED: Plastic scrap. Polyethylene, Polystyrene, Acetate, Acrylic, Butyrate, Nylon, Vinyl. George Woloch, Inc., 514 West 24th Street, New York 11, N. Y.

WANTED: Plastic of all kinds—virgin, reground, lumps sheet and reject parts. Highest prices paid for styrene, polyethylene, acetate, nylon, vinyl, etc. We can also supply virgin & reground materials at tremendous savings. Address your inquiries to: Gold-Mark Plastics Compounds, Inc., 4-05 26th Ave., Long Island City 2, N. Y., RAvenswood 1-0880.

Molds for sale

FOR SALE: Houseware molds, comb molds, also some novelty and specialty items. All in excellent condition. No reasonable offer refused. Send for list. Reply Box 3800, Modern Plastics.

FOR SALE: 80 cavity stirrer sticks mold for producing popsicle sticks, coffee stirrer sticks, etc. This mold is for use on a 16 ounce injector mold machine. Can be seen at the Stylette Plastics, Inc., 148 S. 25th St. Please address your inquiries to Coffee-Ette Food Supply Company, 1500 Ridgely St., Batimore 30, Md.

Molds wanted

WANTED: Bead, novelty jewelry ornament, and jewelry findings injection molds in good used condition for export. Beads, round and shapes from 4mm to 16mm for 2, 4, and 8 oz. machines. Send samples and information to: Debra, Inc., 136 Liberty St., New York 6, N.Y.

TOY MOLDS WANTED: Send basic information. Submit samples if available. Reply box 3807, Modern Plastics.

Help wanted

WANTED: Man with knowledge of extruding; cabable of setting up and operating blow molding plant, New York area. Salary commensurate with ability. Reply fully detailing experience and salary requirements. Reply Box 3808, Modern Plastics.

PLASTIC SALES TRAINEE: Excellent opportunity for a young man with energy and enthusiasm to join the Plastics Division of a rapidly growing organization in a sales trainee position. The man we are seeking should have a technical background and be between the ages of 22 and 30. Possibly he is now employed in a non-sales capacity but has a strong desire to enter the sales field. For the right man we can offer a good starting salary, fringe benefits, and the opportunity to advance in a progressive company. Send resume giving complete details of education, experience, age, and salary requirements. Repy Box 3810, Modern Plastics.

POLYETHYLENE SALESMAN: We seek a man with enthusiasm, drive, and a desire for future progress in a plastics sales assignment. Previous sales experience desirable. Technical background also preferable but not necessary. Location would be Midwest. Excellent opportunity for future advancement exists in a rapidly expanding organization. Please send resume of your experience and salary requirements. Reply Box 3809, Modern Plastics.

(Continued on pg. 236)

(Continued from pg. 234)

SALES REPRESENTATION WANTED: Leading Chicago injection and compression plastic molder wishes to expand—increased sales a must! All territories open including local. John Mack & Son Company, 6227 N. Broadway, Chicago 40, Illinois. Ambassador 2-2525.

PLASTIC ENGINEER: Excellent opportunity in high production packaging field, located in middle west, for experienced development engineer in thermoformed plastic field, able to carry product from concept to production. Prefer man with engineering or chemist degree, 30-40 years of age. Salary dependent on experience and ability. Submit detailed resume including salary requirements. Reply Box 3812, Modern Plastics.

ADHESIVES CHEMIST: Unusual opportunity in Chicago Research laboratories to take charge of adhesives research program for large, well-known national manufacturer, involving diverse applications. A thorough understanding of all principal types of adhesive is required with emphasis on pressure-sensitive and thermosetting material. Must have strong background in organic chemistry and have at least three years experience in adhesives research. Salary commensurate with education and experience. In replying please state age, education, marital status and full description of experience. Reply Box 3813, Modern Plastics.

SOMETIMES IT PAYS TO CARRY WATER ON BOTH SHOULDERS: Be in position to offer your customer both plastic and glass. Glass manufacturer seeks commission salesman selling electrical industry and others in Chicago and adjoining areas. Describe coverage. Reply Box 3814, Modern Plastics.

POLYETHYLENE FILM—SUPERVISOR: Man experienced—flat and tubular film, send complete resume. Reply Box 3815, Modern Plastics.

PLASTIC ENGINEER, MAN: Between 35-45 to work as material engineer—must know plastic materials and have college degree. Will handle research and development projects. Write giving full details to: Paul Proteau, Chicago Molded Products Corp., 1020 N. Kolmar Ave., Chicago 51, Illinois.

SALES REPRESENTATIVES WANTED: Mid-western injection molder seeks qualified custom molding sales agents in several areas. Territories protected. Excellent opportunity for men with experience and ability. Please submit resume of your experience. Replies will be treated in strict confidence. Reply Box 3811, Modern Plastics.

BOTTLE DEPT. MANAGER: Unusual opportunity with progressive West Coast firm for Industrial Manager experienced in bottle manufacturing, plastics or glass. The man we seek must have a good background in engineering with at least 10 years experience in product development, tooling and production. Experience in plastics extrusion and marketing desirable but not necessary. This challengirg position affords unlimited growth possibilities for the right man. Reply Box 3821, Modern Plastics.

PRODUCTION MANAGER: For a flexible plastic foam plant. Experience in cutting and slitting foam rubber or foam plastics desirable but not essential. Must have proven experience and ability in production scheduling, expediting, inventory and quality control, hiring and training personnel. Send resume and salary desired. Reply Box 3820, Modern Plastics.

MANUFACTURERS' REPRESENTATIVE WANTED: Established manufacturer of polyurethane prepolymers for rigid and flexible foams has challenging opportunities in the South and Southeast for representatives currently calling upon the plastic, cushioning, aircraft, electronics, or boating industries. Attractive commission basis. Protected territories. Reply Box 3816, Modern Plastics.

NEW POLYETHYLENE FILM PLANT REQUIRES: Engineer or chemical engineer with approximately five years experience in actual operations of extruding polyethylene film. This is a prime opportunity for a man with operating and supervisory ability to progress with a nationally-known producer of flexible packaging materials. Immediate employment will provide an opportunity to consult and recommend in equipment procurement, plant layout, etc. Liberal employee benefits and retirement program are provided. Salary commensurate with experience. All replies will be held in strictest confidence. Reply Box 3818, Modern Plastics.

PLASTICS ENGINEER CHEMICAL ENGINEER—MECHANICAL ENGINEER B.S.-M.S.-PH.D.: Career opportunity in expanding fiield. Young man with 5-10 years experience in thermoplastics and rubber manufacture, processing and end uses interested in working with process design group in research and development organization. Position involves selecting machinery and equipment for manufacture and processing of thermoplastics and rubber; selecting experimental sheet and pipe extrusion equipment for research and development groups and customers; and consulting with users of machinery and equipment. Sound working knowledge of plastics and rubber processing technology, equipment and suppliers; and ingenuity in adapting and selecting machinery for new applications are requisites. Located in San Francisco bay area. Write giving education, experience and personal history to employment supervisor. Shell Development Company, Emeryville 8, California.

EXTRUSION ENGINEER: AA-1 manufacturer offers unusual opportunity to plastic extrusion specialist capable of taking full manufacturing responsibility for new extrusion division. We seek a man capable of building this new division from scratch, beginning with the purchase of equipment. Experience in polyethylene or other plastic monofilaments would be most helpful. State all facts fully, including education, experience, age and references. Liberal compensation for qualified man. Our employees know of this ad—apply in confidence. Reply Box 3817, Modern Plastics.

SALESMAN: Experienced in selling Hydraulic equipment, presses, injection molders, plastic and allied equipment. Write fully. Aaron Machinery Company, Inc., 45 Crosby Street, New York 12, N.Y.

PERSONNEL: Executive — Technical —Sale—Production. Employers and Applicants—whatever your requirements, choose the Leader in Personnel Placement. Cadillac Associates, Inc., Clem Easly—Consultant to Plastics Industry, 220 South State, Chicago 4, Ill.—WAbash 2-4800. Call, write or wire—in confidence.

PLASTICS MOLDING: Wanted—a man experienced in molding with common sense and technical background to develop a new product using all theories and processes in injection molding known today. Full time, experimental job on 6 oz. Reed-Prentice. We need a man today since we are not in the molding business, but feel that our present product will be better handled by molding. Send complete background so we may know you before interview. All data will be held in strict confidence. Reply Box 3819, Modern Plastics.

Situations wanted

MANUFACTURERS' REPRESENTATIVE: With established contacts among industrial purchasing agents in Northern Ohio desires connection with Custom Compression Molder. Can offer aggressive sales force with engineering background. Presently handling Class 'A' Injection Molder. References if necessary. Reply Box 3822, Modern Plastics.

MANUFACTURERS' REPRESENTATIVE: Available to handle injection, extrusion and compression equipment, raw materials, molded and extruded products in Metropolitan New York and Philadelphia, New Jersey and Connecticut. Other broad sales and technical experience in thermoplastic field. Reply Box 3823, Modern Plastics.

Miscellaneous

FOR SALE: A fully paid exclusive license for vacuum forming plastic sheets under U.S. Patent No. 2,493,439, issued January 3, 1950, excluding therefrom the manufacture or use of relief maps and globes produced with the aid of said patented method and/or apparatus. Reply Box 3834, Modern Plastics.

WANTED TO BUY: Small plastic extruding firm. Reply Box 3825, Modern Plastics.

WANTED FOR EXPORT: Tablet press. 200 ton #5 Defiance. Hydraulic molding presses, 75 to 300 ton cap. Large platens, long strokes, large dalite openings. With or without power units. Any condition. Reply Box 3826, Modern Plastics.

COMPRESSION MOLDER: Proprietary lines (custom experience) 50 miles N.Y. Excess 12000' modern space. Idle 8 presses. Seeks connection with plastic molder (or allied industry). We offer markedly curtailed overhead. Complete flexibility arrangements. Principals only. Reply Box 3827, Modern Plastics.

AUSTRALIAN ADHESIVE: Manufacturers with Australia wide coverage, adequate manufacturing facilities and finance invite propositions for manufacturers of specialty adhesives suitable for various industries. No. 3212 c/-Box 1627 G.P.O. Sydney, Australia.

CAPITAL TO INVEST: Commercial and real estate financing. 1st & 2nd Mortgages. Construction loans. Chattel loans on machinery, equipment, fixtures & inventory. Sales & leaseback. Present financing consolidated and increased. Payments reduced. Receivable discounting. Re-discounting and installment financing. Long term subordinated note and debenture financing. New ventures financed. Promotional financing. Sy Field Co., 1457 Broadway, N. Y. WI 7-7395.

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Closing date: 24th of second preceding month, e.g., August 24 for October issue

Per inch (or fraction)..... $20.00; each 3 inches or fraction (in border) $10.00 extra

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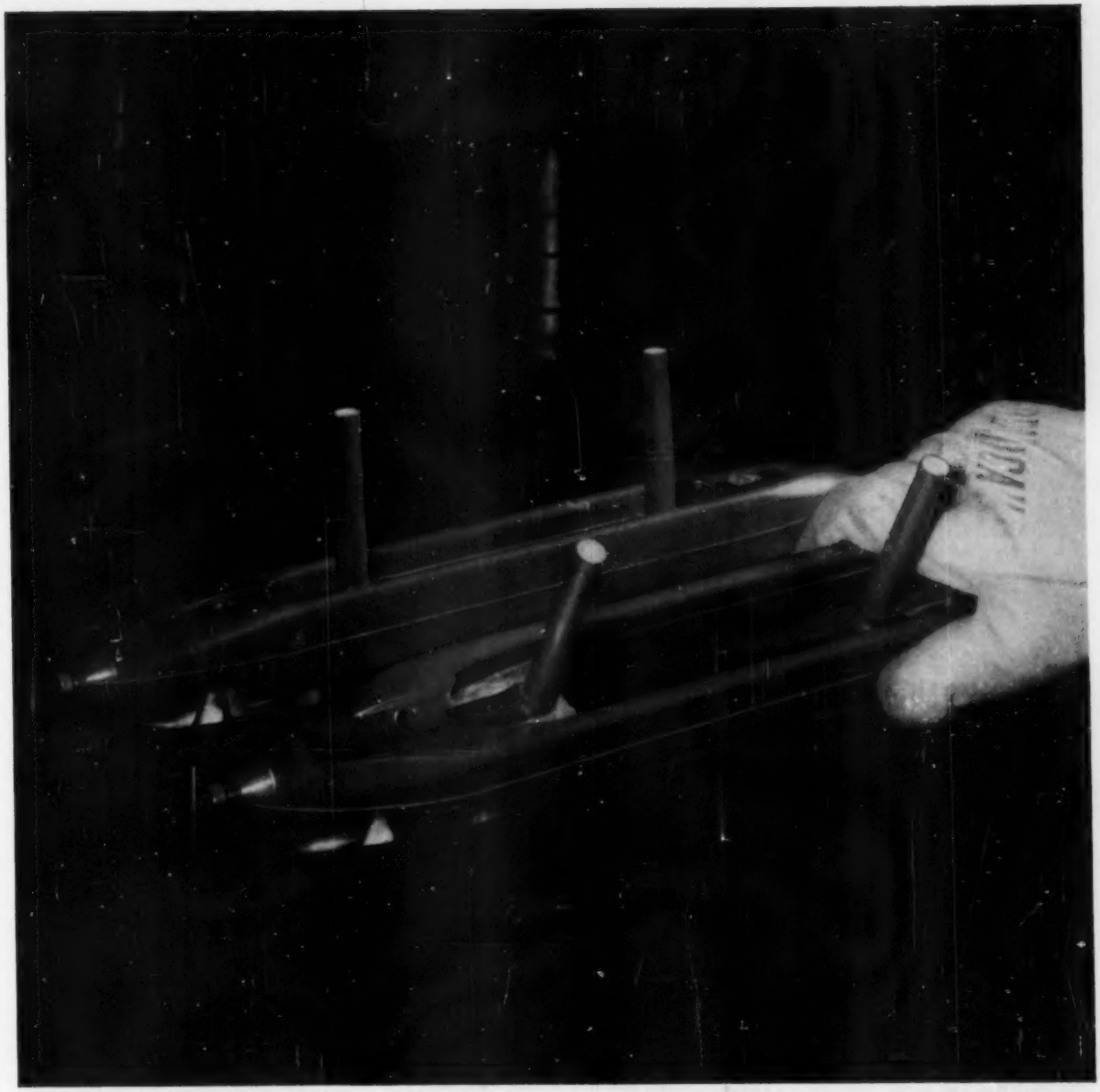
For further information address Classified Advertising Department, Modern Plastics, 575 Madison Avenue, N. Y. 22, N. Y.

Modern Plastics reserves the right to accept, reject or censor classified copy.



STAND-IN FOR NATURE – Despite the long dominance of the dogwood tree as a basic raw material for the production of quality textile shuttles, plastics have been making remarkable inroads, recently, as an alternate material. This unique shuttle is made entirely of resin impregnated duck and is the result of nearly ten years of intense research and development by Draper Corporation, and Formica Corporation. The sidewall inserts are cut beforehand from a special, pre-cured laminate. Then, the entire shuttle is formed by a combination of compression and plunger moulding. The result is an unusually sturdy shuttle which Formica Corporation claims will last at least twice as long as the best wooden shuttle available. Made for Draper Corporation, the shuttles are produced in nine different models. One of the components used for the laminate with which the shuttles are made is Mount Vernon duck.

This is another example of how fabrics made by Mount Vernon Mills, Inc. and the industries they serve, are serving America. Mount Vernon engineers and its laboratory facilities are available to help you in the development of any new fabric or in the application of those already available.

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Index of Advertisers

August 1958

Distribution of this issue: 32,000

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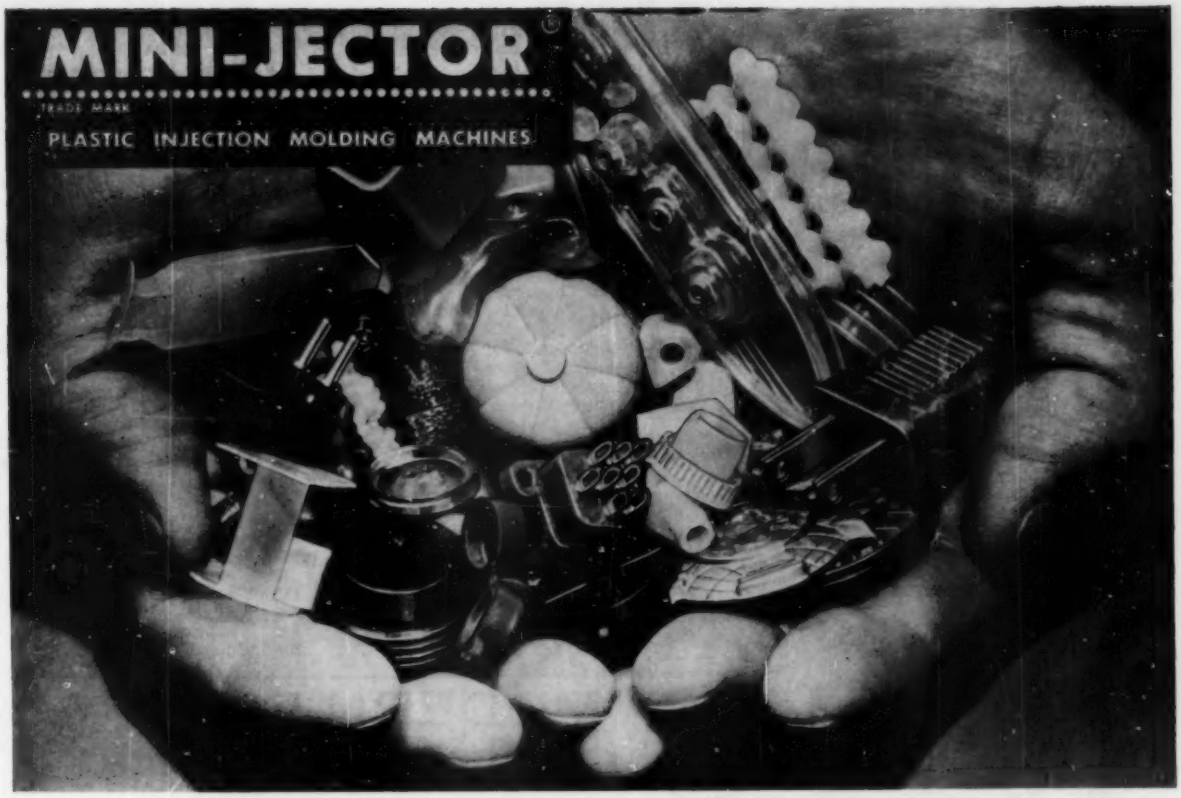


MORE VARIETY at LOWER COST!

Save thousands of dollars in mold costs with MINI-JECTOR. Eliminate "big-press" high-per-piece tooling expenses!

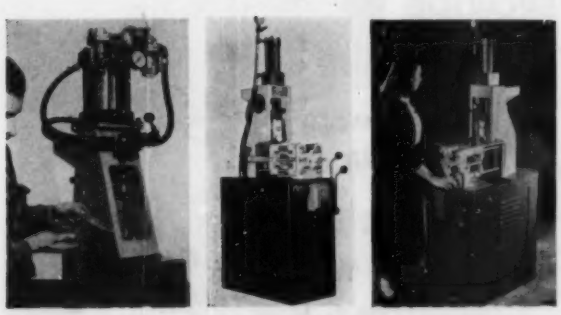
Over $4000 saved on one of the above items alone. Details on request. The more variety, the bigger the savings. Flexible, efficient MINI-JECTOR Plastic Injection Molding Machines answer the critical need for lower cost development and production of fast-changing varieties of small precision-molded plastic items. Savings begin with low initial investment for machine (under $1000) and mold-blanks (as low as $29.50).

More important are the major savings in time, trouble, and money developing and producing wide varieties of items by eliminating complex, costly big-press tooling where not required.

MINI-JECTOR solves your "tight margin" runs (from test samples to moderate production); also tricky "insert" molding up to 1 oz. capacities in all thermoplastics, including Nylon. Compact, simple to operate; lever and push-button control models; air or hydraulic power to fit your facilities.

See complete MINI-JECTOR Line of Machines and Accessories. Illustrated catalog presents detail specifications; technical data on performance, applications; and the newest developments in plastic injection molding techniques. Shows how MINI-JECTOR has modernized methods in hundreds of plants. **Mailed free at your request (send the coupon) to**

Newbury Industries, Inc.,
Box 396, Newbury, Ohio.



(left) **Model 45 "Wasp"** (bench), fast, low-cost insert molding and encapsulating up to 1 oz. (center) **New "Universal" Model** combines features of 4 most popular MINI-JECTORS. (right) **Model 60 "Super-Hornet"** for most economy in moderate, conventional molding. Other models to suit your exact needs (see catalog).

NEWBURY INDUSTRIES, Inc.
Box 396, Newbury, Ohio

Send new catalog immediately (no cost).

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For convenience: clip coupon to your letterhead and mail.

(Continued from page 238)

MODERN PLASTICS
A BRESKIN Publication
Published by Breskin Publications Inc., 575 Madison Ave., New York 22, N. Y.

THE GIANT NOVEMBER SHOW ISSUE*

of MODERN PLASTICS

. . . will reach the plastics market at the *peak* of its interest in materials, equipment, and special services!

. . . will be *the* most effective advertising issue of the year for suppliers to the plastics field!

. . . will have the *largest* circulation in the magazine's history!

*coinciding with the Eighth National Plastics Exposition to be held at the International Amphitheatre, Chicago, November 17-21, 1958.

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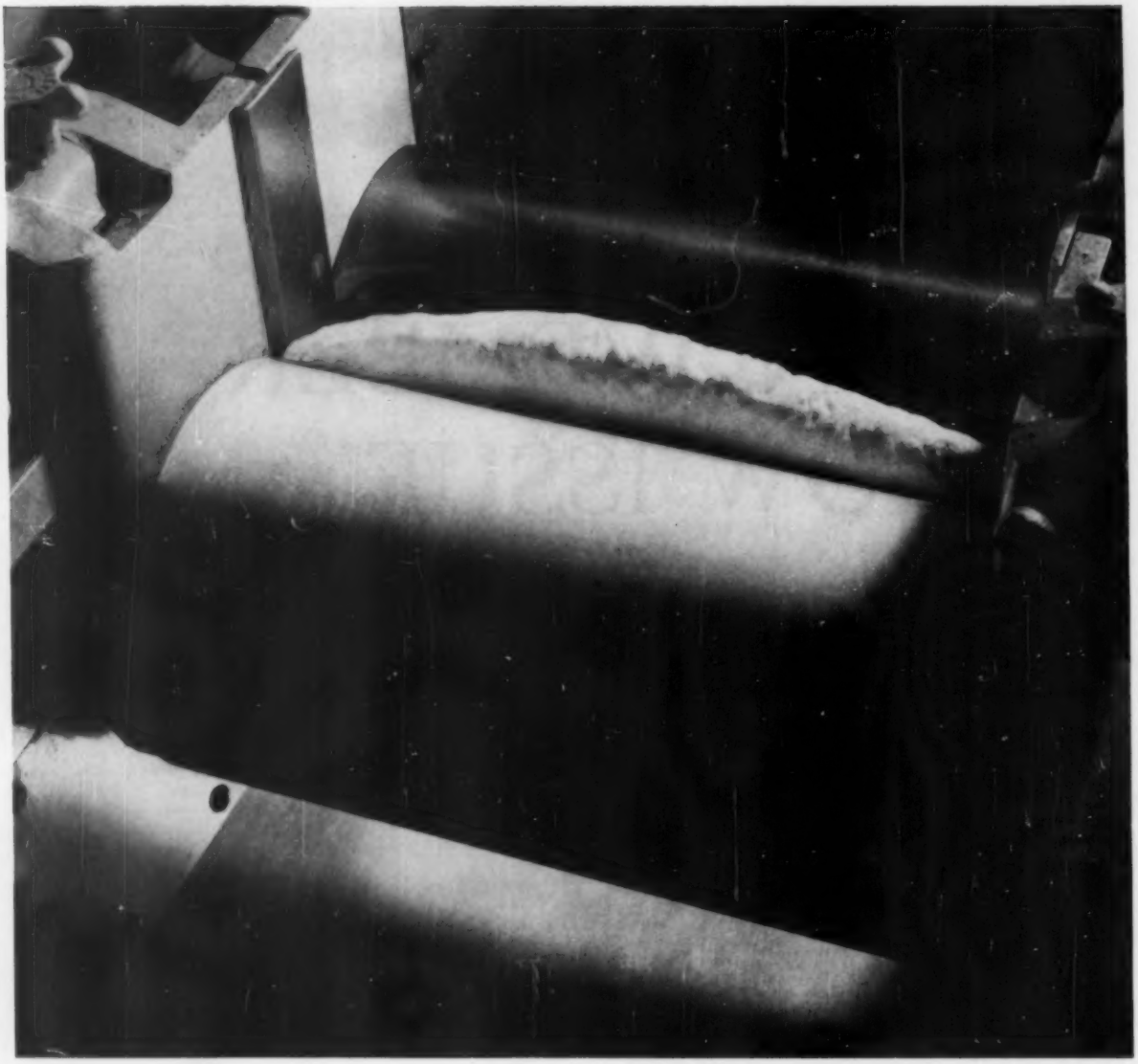

NOW — fluid banks, no tear with Diamond PVC-30

Look at this sheet on the mill! Note especially the smooth surface, the smooth-flowing rolling bank, the absence of ragged edges. Result: faster, more economical production of calendered sheeting . . . now possible with compounds that contain Diamond's NEW PVC-30, latest addition to a growing family of low molecular weight PVC resins.

DIAMOND PVC-30 can replace copolymers you may be using now as processing aids. It costs less, has better heat stability, retains high flow characteristics . . . giving you faster, more economical processing at lower temperatures.

Other low molecular weight resins from Diamond are PVC-35, recommended for injection molding compounds at moderate temperatures; and PVC-40, recommended for rigid and flexible sheeting which provides the best balance between physical properties and easy processing.

For more information, write Diamond Alkali Company, 300 Union Commerce Building, Cleveland 14, Ohio.

Diamond Chemicals

IF YOU'RE just beginning to manufacture alkyd or polyester resins—or an "old-hand" producer with some production problems still unsolved—Pittsburgh's Technical Service Department may be of real service to you.

As a dependable source of phthalic anhydride, maleic anhydride and fumaric acid, we're well experienced—and *ready*—to assist you with your application problems.

This help goes well beyond "samples and data sheet" on our products—which are always available, of course. We'll be glad to make up sample resins, suggest formulations for your special requirements, and recommend sound processing procedures.

And, when the problem calls for it, our engineers are at your service for a trouble-shooting meeting at your plant. Pittsburgh is *not* a commercial resin producer.

What's your resin production problem? We'd like to help you lick it. *Call or write us the details today.*

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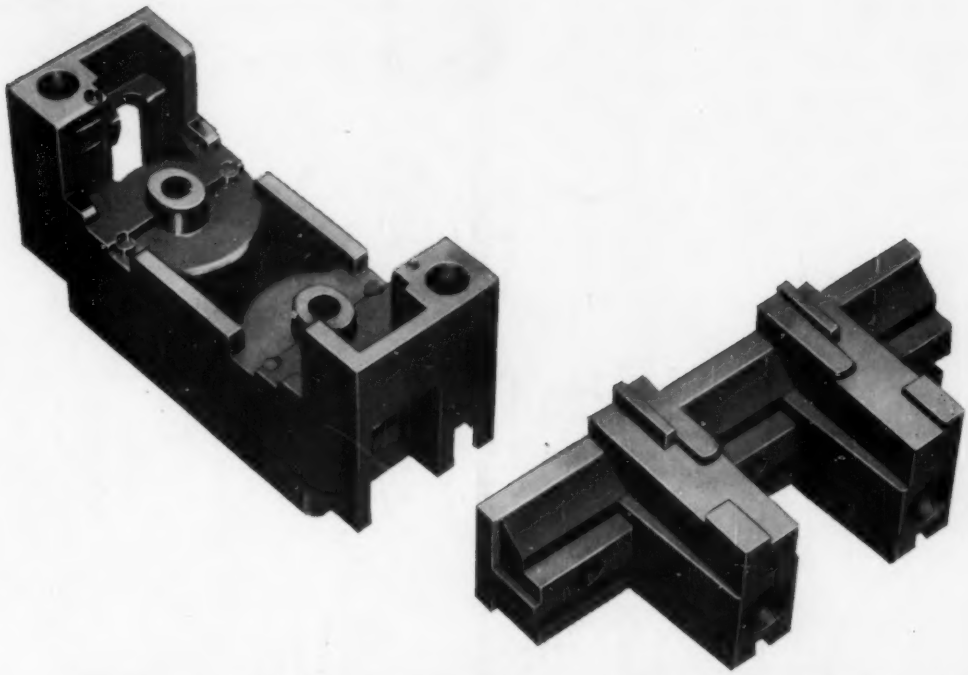
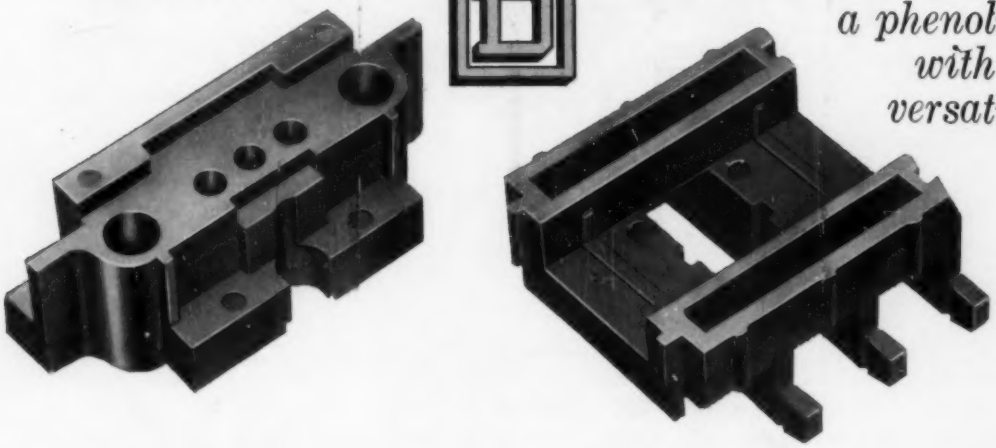


HERE'S WHY SQUARE D CHOSE G-E 12929 . . .

a phenolic with versatility



SQUARE D COMPANY *of Peru, Indiana uses G-E 12929 general-purpose phenolic compound for molding electrical parts like these. Clockwise from upper left: lug base for circuit breaker, plug fuse base, pole barrier, bus and neutral support.*

Square D Company needed a phenolic that could be molded on automatic presses to produce electrical parts of many different sizes, shapes, and uses. Their specifications also required good dimensional stability, rigidity, high heat resistance, low water absorption, outstanding electrical properties.

Square D chose G-E 12929 because it fits *all* of these requirements—and has good moldability as well.

G-E 12929 is easy to set up on any compression or plunger molding equipment. Cure cycle is short. The compound can tolerate a wide temperature range during molding. It is not critical with respect to other molding variables. One flow covers many different parts, including those with thick and thin sections. High barriers fill out well.

Here is another example of the extra values molders realize from phenolics—lowest in price of thermosetting materials, highest in performance where the specifications call for exceptional heat resistance, dimensional stability and rigidity.

For more complete information about G-E 12929 and other G-E compounds, write General Electric Company, Chemical Materials Dept., Section MP 78, Pittsfield, Mass.

Phenolics-first of the modern plastics...first in value

GENERAL ELECTRIC